

INSTALLATION AND OPERATION MANUAL
FOR SEA TEL MODEL
DTV04 HD 5LNB TVRO ANTENNA



WARNING: Antenna Pedestal *must be properly restrained (stowed)* to prevent damage to wire rope isolators, isolator springs and/or antenna pedestal mechanism during underway conditions *when power is removed from the antenna assembly*.

Sea Tel, Inc.
4030 Nelson Avenue
Concord, CA 94520
Tel: (925) 798-7979
Fax: (925) 798-7986
Email: seatel@cobham.com
Web: www.cobham.com/seatel

Sea Tel
COBHAM

Sea Tel Europe
Unit 1, Orion Industrial Centre
Wide Lane, Swaythling
Southampton, UK SO 18 2HJ
Tel: 44 (0)23 80 671155
Fax: 44 (0)23 80 671166
Email: seatel@cobham.com
Web: www.cobham.com/seatel

Sea Tel Inc doing business as Cobham SATCOM

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Sea Tel Marine Stabilized Antenna systems are manufactured in the United States of America.



Sea Tel is an ISO 9001:2000 registered company. Certificate Number 19.2867 was issued August 12, 2005. Sea Tel was originally registered on November 09, 1998.



The Series 04 Family of Marine Stabilized Antenna Pedestals with DAC-2200 Antenna Control Unit complies with the requirements of European Norms and European Standards EN 60945 (1997) and prETS 300 339 (1998-03). Sea Tel European Union Declaration of Conformity for this equipment is contained in this manual.

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Marine Stabilized Antenna Systems

European Union Declaration of Conformity

Marine Navigational Equipment

The EU Directives Covered by this Declaration:

European Norms and European Standards EN 60945 (1997) and IEC 1000 (1995).

The Product Covered by this Declaration:

Series 04 Family of Marine Stabilized Antenna Pedestals with DAC-2200 Antenna Control Unit and TSC-10 Touch Screen Controller.

The Basis on which Conformity is being Declared:

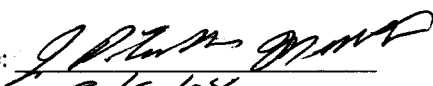
The product identified above complies with the requirements of the above EU Directives by meeting the following standards:

*** EN 60945 (1997) "Marine Navigational Equipment - General Requirements – Methods of Testing and Required Test Results":**

- Conducted Emissions (Clause 9.1 & 9.2)
- Radiated Emissions (Clause 9.1 & 9.3)
- Conducted Low Frequency (Audio) Interference (Clause 10.1 & 10.2)
- Conducted Radio Frequency Interference (Clause 10.3) & IEC 1000-4-6 (1995)
- Radiated Radio Frequencies (Clause 10.4) & IEC 1000-4-3 (1995)
- Fast Transients on Signal/Control Lines (Clause 10.5) & IEC 1000-4-4 (1995)
- Surges on AC Power Lines (Clause 10.6) & IEC 1000-4-5 (1995)
- Power Supply Short-Term Variation (Clause 10.7)
- Power Supply Failure (Clause 10.8)
- Electrostatic Discharge (Clause 10.9) & IEC 1000-4-2 (1995)
- Compass Safe Distance (Clause 11.2, Measurement Only)

The technical documentation required to demonstrate that this product meets the requirements of the EMC Directive has been compiled by the signatory below and is available for inspection by the relevant enforcement authorities. The CE mark was first applied in June 8, 2004.

Authority: Mr. J. Patrick Matthews
President

Signature: 
Date: 7/8/04

Attention

The specifier, purchaser, installer or user is responsible for assuring adherence to special measures and limitations which must be observed when this product is placed into service, or modified, in order to ensure its compliance with the above directives.

TVRO LNBs which are mounted on the Marine Stabilized Antenna Pedestal must be CE marked separately by the manufacturer of those components.



Sea Tel, Inc.
4030 Nelson Ave.
Concord, CA. 94520
Phone: (925) 798-7979
Fax: (925) 798-7986



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1. Introduction

1.1. General Description of system

This shipboard TeleVision Receive Only (TVRO) system provides you with maritime DIRECTV® satellite programming while you are inport or underway. Your DTV04 HD Antenna system will automatically locate and receive signals of adequately high E.I.R.P. levels (see the Specifications section of this manual), in circular polarization mode from 5 geosynchronous DIRECTV satellites in both Ku-band and Ka-Band simultaneously. This input will be distributed to all of your satellite TV receivers which will provide the Audio/Video to your televisions.

The DTV04 HD system is a fully stabilized antenna that has been designed and manufactured so as to be inherently reliable, easy to maintain, and simple to operate. Except for start-ups, or when changing to operate with different transponders, the equipment essentially permits unattended operation.

The DTV04 HD system consists of two major groups of equipment; an above-decks group and a below-decks group. Each group is comprised of the items shown, and listed, below. All equipment comprising the Above Decks is incorporated inside the radome assembly and is integrated into a single operational entity. In addition to the provided equipment this system requires an unobstructed line-of-sight view to the satellites, ships Gyro Compass input and AC electrical power. The IF signals from the antenna are distributed to the satellite receivers by the matrix switch. Video and Audio outputs from your satellite receivers are available for distribution and monitoring.

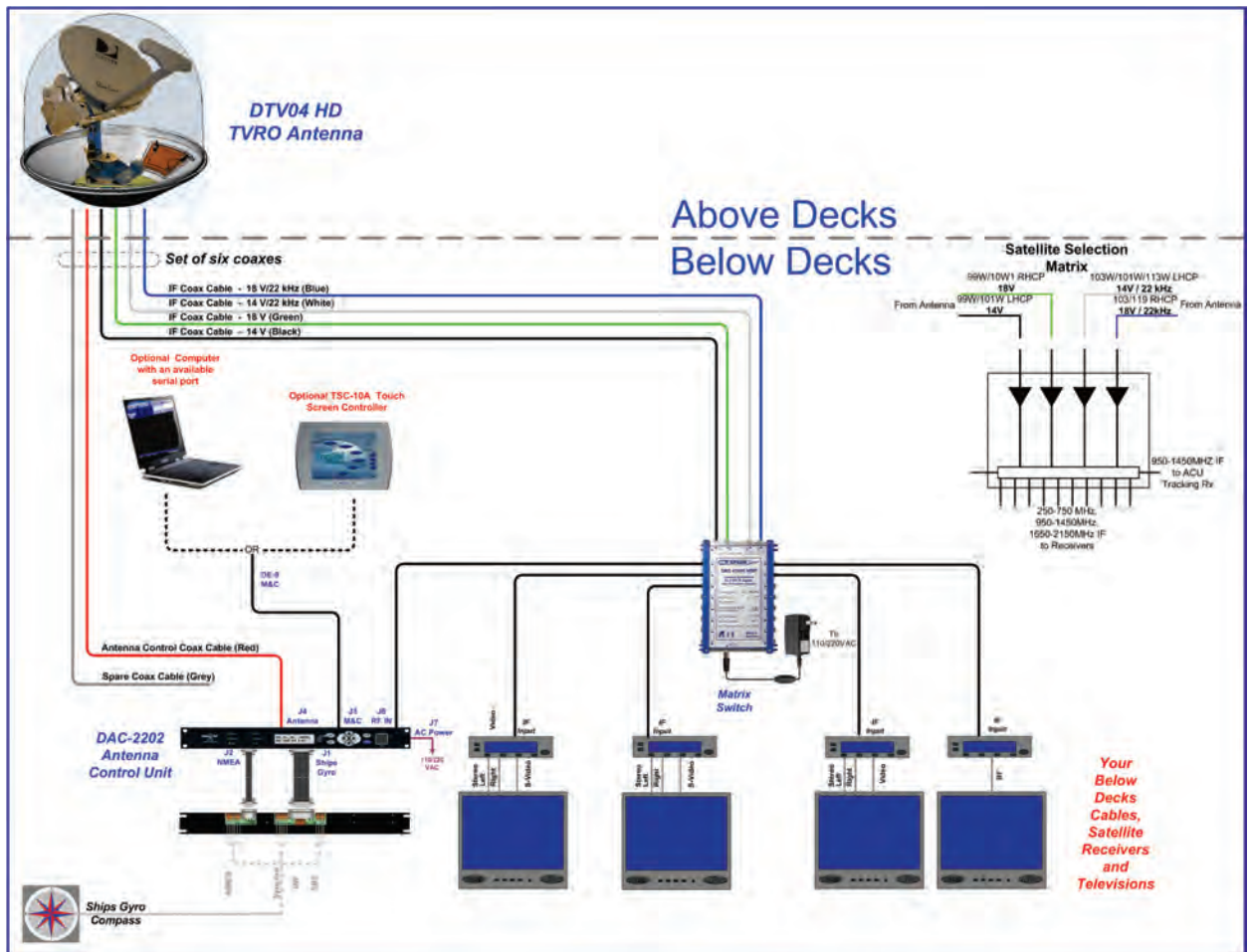


Figure 1-1 DTV04 Simplified Block Diagram Components

For more information about these components, refer to the Basic System Information section of this manual.

A. Above-Decks Equipment (ADE) Group

1. Stabilized antenna pedestal with built-in GPS
2. 32.5" Offset Antenna Reflector
3. Feed Assembly with DIRECTV 5 LNB
4. 50" Radome Assembly

B. Below-Decks Equipment Group

5. DAC-2202 Antenna Control Unit
6. (Customer furnished) DIRECTV 5 LNB compatible **active** Matrix Switch with desired number of outputs (one output required for ACU Tracking receiver and one output for each installed satellite receivers).
7. (Customer furnished) Satellite Video Receiver(s) & Television(s)
8. (Customer furnished) Required Coaxial, Serial, Audio/Video, and AC Power Cables.

1.2. General scope of this manual

This manual describes the Sea Tel Model DTV04 HD Antenna (also called the Above Decks Equipment), its operation and installation. The Below Decks Equipment is described in the manuals provided with your DAC-2202 Antenna Control Unit

1.3. Quick Overview of contents

The information in this manual is organized into chapters. Operation, basic system information, installation, setup, functional testing, maintenance, specifications and drawings relating to this TVRO Antenna are all contained in this manual

2. Operation

Operation of your system is accomplished from the Antenna Control Unit (ACU). Please refer to the operation section of the DAC-2202 Antenna Control Unit manual.

2.1. System Power-up

Turn ON the power switch on the front panel of the ACU. The DTV 04 HD Antenna receives its DC power from the Antenna Control Unit (ACU) when the ACU is energized.

The ACU supplies +30 VDC and FSK Modulated RS422 at 70 KHz (TX) & 120 KHz (RX) to the ADE on the Antenna Control Coax Cable.

2.2. Antenna Initialization

A functional operation check can be made on the antenna stabilization system by observing its behavior during the 4 phases of initialization.

Step 1. Turn on the AC power switch at the ACU front panel. Verify the level platform motor drives the level cage CCW to the stop and then CW 45 degrees.

Step 2. Verify the antenna moves forward or back to bring the top of the level cage to a level position in the fore/aft direction. This step takes approximately 10 seconds and will result in the dish being at 45 degrees in elevation. The level cage may still be tilted left or right at this time.

Step 3. After the level cage is positioned in the fore/aft direction, verify the antenna moves left or right to bring the top of the level cage to a level position in the left/right direction. This step also takes approximately 10 seconds.

Step 4. After the level cage is positioned in the left/right direction, verify the antenna moves CW (up) in azimuth to the upper stop where the Relative position of the antenna will be 700.0 degrees. From this point on the encoder will increment and/or decrement the Relative position of the antenna. Next, the antenna will drive CCW (down) in azimuth to a Relative position of 630.0.

The antenna will report its status, the PCUs model number & software version and the position information (current Relative, Azimuth and Elevation) to the ACU.

If any of these steps fail, or the ACU reports model number as "xx04" re-configure the PCU as described in section the Setup section of the AU manual. If initialization still fails, refer to the troubleshooting section of this manual.

2.3. Antenna Stabilization

After initialization is complete, real-time stabilization of the antenna is an automatic function of the PCU.

2.4. Antenna Pedestal Operation

Operation of the stabilized antenna Pedestal Control Unit (PCU) is accomplished remotely by the DAC-2202 Antenna Control Unit (ACU). Refer to the Operation section of the DAC-2202 Antenna Control Unit (and/or TSC-10 Touch Screen Controller) manual for more specific operation details. There are no other operating instructions applicable to the pedestal assembly by itself.

2.5. Tracking Operation

The design of this system allows for simultaneous reception of 5 satellites, 3 at Ku-Band and 2 at Ka-Band. For the DTV04 HD Antenna system all tracking parameter entries are based on signal level received from 101°W.

Tracking optimizes the antenna pointing, in very fine step increments, to maximize the level of the satellite signal being received. The mode of tracking used in this antenna is a variation of Conical Scanning called DishScan. Tracking is controlled by the ACU. You can toggle Tracking ON/OFF from the ACU, or from the optional Touch Screen Controller.

DishScan continuously drives the antenna in a very small circular pattern at 60 RPM. The ACU evaluates the received signal throughout each rotation to determine where the strongest signal level is (Up, Right, Down or Left) and issues the appropriate Azimuth and/or Elevation steps to the antenna, as needed.

2.6. Reflector Skew Operation

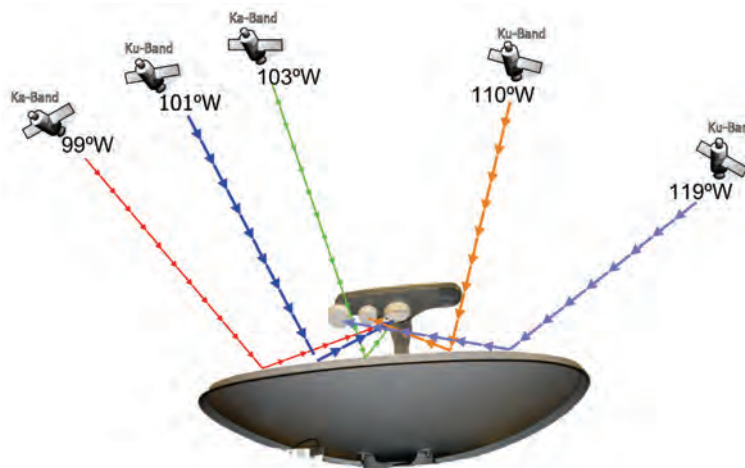
In addition to azimuth and elevation pointing angle requirements, it is necessary to skew the angle of the reflector to the satellite. This is to properly align the LNBF assembly array with the desired satellites. The required amount of skew in degrees (CW or CCW) from center of range is based on the vessels geographic location and DIRECTV satellite 101°W. To facilitate this need, your antenna is equipped with a Reflector Skew motor and potentiometer feedback. Other than initial calibration, this function does not require any user intervention or adjustments.

Refer to the maintenance section of this manual for procedures to align and optimize this tilt angle while in Auto-Pol mode.

2.7. Low Noise Block Converter Operation

Your system has a DirecTV 5 LNB feed assembly installed onto it for simultaneous reception of 99°W, 101°W, 103°W, 110°W, & 119°W. There are no operating instructions applicable to the LNB's via the Antenna Control Unit. The feed is energized and controlled by the DirecTV 5 LNB compatible active matrix switch and DirecTV compatible satellite receiver(s).

The received Satellite signals are circular polarized (spiraling plane down from the satellite) at both Ku and Ka-band Frequency range. This system is specifically designed to work with DirecTV service and therefore does not support tracking of Linear Satellite signals.



2.8. Radome Assembly Operation

When operating the system it is necessary that the radome access hatch (and/or side door) be closed and secured in place at all times. This prevents rain, salt water and wind from entering the radome. Water and excessive condensation promote rust & corrosion of the antenna pedestal. Wind gusts will disturb the antenna pointing.

There are no other operating instructions applicable to the radome assembly by itself.

3. Basic System Information

This section provides you with some additional information about the satellites you will be using, basics of the your Series 04 antenna system and other equipment within your system configuration.

3.1. Satellite Basics

The satellites are in orbit at an altitude of 22,753.2 Statute Miles positioned directly above the equator. Their orbital velocity matches the Earth's rotational speed, therefore, each appears to remain at a fixed position in the sky (as viewed from your location).

These satellites are simply relay stations that are able to receive signals from one location on the globe and re-transmit them to a much larger area on the globe than a local TV Station antenna could do. Because of their high vantage point, they are able to cover an area that is larger than a continent.

Your DTV04 HD antenna is designed to be used with DIRECTV Satellites that operate at both the Ku-Band (12.2-12.7GHz) and Ka-Band (18.3 – 18.8GHz and 19.7 – 20.2GHz) in this orbit that have a strong enough receive signal level in your location.

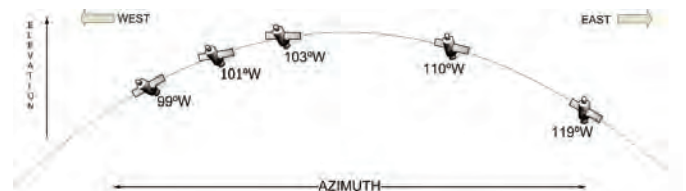


Figure 3-1 Arc of viewable Satellites

3.1.1. Ku-Band Frequency

The three satellites that your system will be tracking, 101°W, 110°W, and 119°W operate in the 12.2-12.7GHz range. At these frequencies the signal from the satellite travels only in a straight line and is affected by weather changes in the atmosphere. There are several conditions that can cause a temporary loss of satellite signal, even within an area where the signal level is known to be adequate. The most common of these *normal* temporary losses are **blockage** and **rain fade**. They will normally interrupt services only as long as the cause of the loss persists.

3.1.2. Ka-Band Frequency

The two satellites that your system will be tracking, 99°W and 103°W operate in the 18.3 to 20.2GHz range. At these frequencies the signal from the satellite travels only in a straight line and is affected by weather changes in the atmosphere. There are several conditions that can cause a temporary loss of satellite signal, even within an area where the signal level is known to be adequate. The most common of these *normal* temporary losses are **blockage** and **rain fade**. They will normally interrupt services only as long as the cause of the loss persists.

Rain Fade - Atmospheric conditions that may cause sufficient loss of signal level include rain, snow, heavy fog and some solar activities such as sun spots and solar flare activity. The most common of these is referred to as "rain fade". Rain drops in the atmosphere reduce the signal from the satellite. The heavier the rain, the greater the signal loss. When the amount of loss is high enough, the antenna will not be able to stay locked onto the satellite signal. Once the amount of rain has decreased sufficiently, the antenna will re-acquire the satellite signal. In strong signal areas, rain fall of about four inches per hour will cause complete loss of signal. In weaker signal areas, lighter rainfall might cause the signal to be lost. Typically Ka-Band signals are more sensitive to the effects of rain fade and other environmental factors when compared to Ku-Band signals transmitted at the same power level.

Blockage - Blockage is loss due to an object in the path of the signal from the satellite to the dish. If an object that is large and dense is positioned in the path of the signal from the satellite, it will prevent sufficient signal from arriving at the dish. The signal can not bend around, or penetrate through, these objects. The reception will be degraded or completely interrupted until the object is no longer in the path of the signal to the dish. The dish is actively driven to remain pointed at the satellite (toward the equator) so, as the boat turns a mast or raised structure on the boat may become positioned between the satellite and the dish. Blockage may also be caused a person standing near the radome, tall mountains, buildings, bridges, cranes or other larger ships near your boat. Signal will be lost when the boat is housed inside an enclosure that the signal cannot penetrate, like a paint shed or a berth with a roof. Moving or rotating the boat to position the antenna where it has an unobstructed view to the desired satellite will restore the antennas ability to receive the satellite signal.



Due to the nature of the reflector/feed design it is possible to have blockage to 1 or more satellites even while actively tracking 101°W.

- The graphic to the right depicts a vessel with its' BOW oriented such that the two "diesel Stacks" at the vessels aft are situated so that they do not cause any physical blockage, thus allowing full line of site to all 5 DIRECTV satellites.

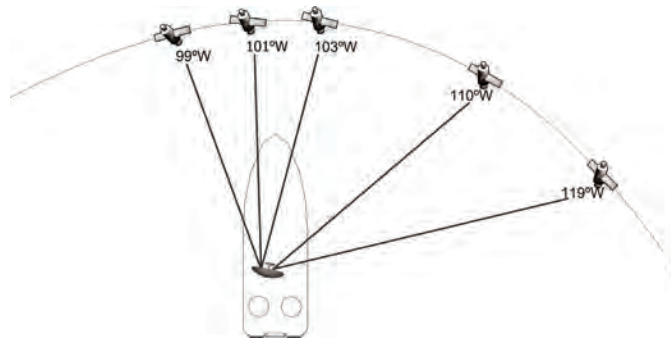


Figure 3 System tracking with line of site to all 5 satellites*

- The graphic to the right depicts a vessel with its' BOW oriented such that the two "diesel Stacks" at the vessels aft are situated so that they do cause physical blockage thus allowing line of site to only 2 of the 5 DIRECTV satellites. Satellites 99°W, 101°W, and 103°W are blocked by the two stacks. This is the only scenario (of the three examples listed on this page) where a properly defined blockage zone would trigger a **BLOCKED** status.

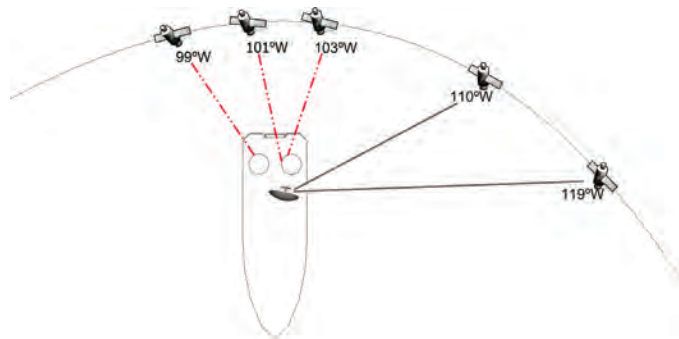


Figure 4 System in a blocked condition*

- The graphic to the right depicts a vessel with its' BOW oriented such that the two "diesel Stacks" at the vessels aft are situated so that they cause partial physical blockage thus allowing line of site to only 3 of the 5 DIRECTV satellites. Satellites 110°W and 119°W are blocked by the two stacks.

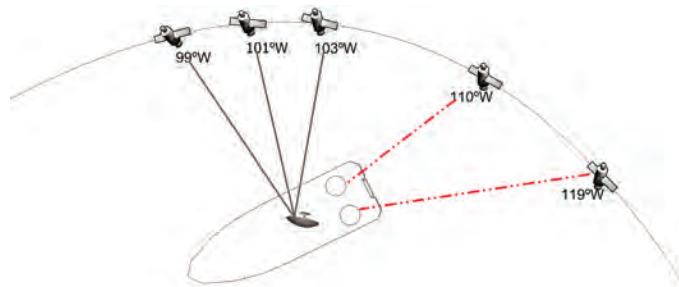


Figure 5 System in a partially blocked condition.*

*For illustration purposes only. The relative azimuth angle(s) between the antenna and the satellites shown in these graphic are exaggerated and not drawn to scale. The actual relative azimuth delta between the 5 satellites will vary and is based on the vessels current geographic location.

3.1.3. Signal level

The level of the receive signal at any given geographic location globe is dependent upon how powerful the transmission is and how wide the signal beam coverage area is. Focusing the signal into a narrower beam concentrates its energy over a smaller geographic area, thereby increasing the signal level throughout that area of coverage. This makes it possible for you to use a smaller antenna size to receive that satellite signal. The antenna system must be geographically located in an area where the signal level from the satellites meets (or exceeds) the minimum satellite signal level required for the antenna (refer to the Specifications section of this manual) to provide suitable reception. This signal level requirement may limit the number of satellites that can be used and the geographic areas where the ship can travel. When traveling outside this minimum signal coverage area, it is normal for the system to experience an interruption in its ability to provide the desired satellite services until entering (or re-entering) an area of adequate signal level. Tracking decisions are based on single satellite and therefore is possible to have your system report proper tracking status and still not be within coverage of one of the other 4 satellites.

3.1.4. Satellite polarization

Satellites may transmit their signals in one of two different polarization modes, linear (like a flat ribbon down from the satellite) or circular (like a twisted ribbon spiraling down from the satellite). The DTV04 HD antennas are designed to receive circular satellite signals only.

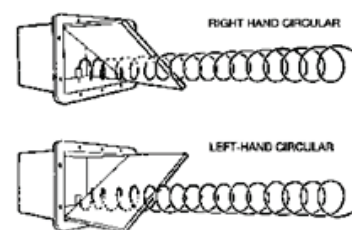


Figure 3-5 Satellite Signal Polarization

3.2. Antenna Basics

The satellite dish is mounted on a three jointed pedestal. As your boat rolls, pitches and turns in the water, these three joints move to keep the dish pointed at the satellite. The following information is provided to explain some of the basic functions of the antenna:

3.2.1. Azimuth

The clockwise, or counter-clockwise, rotation of the antenna is called Azimuth rotation. The antenna can rotate a total of 680 degrees between two mechanical stops. Azimuth drive, provided by the azimuth motor, is required during stabilization, searching, tracking and unwrap operations of the antenna. As the boat turns, azimuth is driven in the opposite direction so the dish remains pointed at the desired satellite. The actual azimuth pointing angle to the satellite is determined by the ships latitude & longitude and the longitude of the satellite. It is important to know that the antenna should be pointed (generally) toward the equator.

If the ship is in the Northern Hemisphere, the azimuth angle to the satellite would be 180 degrees true (relative to true north) if the satellite is on the same longitude as the ship. If the satellite is east or west of your longitude, the azimuth will be less than, or greater, than 180 degrees respectively.

When checking for blockage you can visually look over the antenna radome toward the equator to see if any objects are in that sighted area. If you are not able to find any satellites it may also be useful to remove the radome top to see if the dish is aimed the correct direction (towards the equator).

3.2.2. Elevation

The antenna can physically be rotated in elevation from -15 degrees (lower stop) to +110 degrees (upper stop). However, you will only be pointing elevation between 00.0 (horizon) and 90.0 (zenith). Elevation drive, provided by the elevation motor, is required during stabilization, searching and tracking operations of the antenna. The actual elevation pointing angle to the satellite is determined by your latitude & longitude and the longitude of the satellite. In general terms, the elevation angle will be low when the ship is at a high latitude and will increase as the ship gets closer to the equator.

Additionally, from any given latitude, the elevation will be highest when the desired satellite is at the same longitude that you are on (refer to figure 3-1). If the desired satellite is east, or west, of your longitude the elevation angle will be lower.

3.2.3. Antenna Reflector/Feed Assembly

This section is comprised of a stamped aluminum offset reflector with a DIRECTV Slimline Ku/Ka band 5LNBF assembly. This assembly is also fitted with a 24Vdc tilt motor and a potentiometer for position feedback required for proper reflector skew which is remotely controlled by the DAC2202 based on the vessel's GEO location.



Figure 7 Antenna Reflector/Feed Assembly

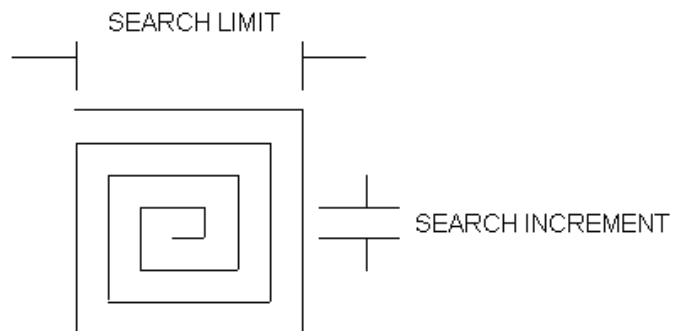
3.2.4. Stabilization

The DTV04 HD antennas are stabilized in three axes of motion. Stabilization is the process of decoupling the ship's motion from the antenna. Simply put, this allows the antenna to remain pointed at the satellite while the boat turns, rolls or pitches under it. To accomplish this, the Pedestal Control Unit (PCU) on the antenna pedestal senses any motion of the antenna and immediately applies drive to the appropriate motor(s) to oppose the sensed motion. Azimuth (AZ), Elevation (EL) and Cross-Level (left-right tilt) are actively stabilized automatically by the PCU as part of its normal operation.

3.2.5. Search Pattern

Whenever the desired satellite signal is lost the Antenna Control Unit after a preprogrammed time delay will automatically initiate a search to re-acquire the desired signal.

The search is conducted with alternate azimuth and elevation movements. The size and direction of the movements are increased and reversed every other time resulting in an expanding square pattern.



When the antenna finds the desired satellite signal, the ACU will automatically stop searching and begin Tracking and identifying the signal. Tracking optimizes the pointing of the antenna to get the highest signal level from the satellite.

3.2.6. Tracking Receiver - Satellite Identification Receiver

The Satellite Identification Receiver located in the Antenna Control Unit (ACU) is used to acquire, identify and track a specific satellite by a unique network ID code (NID). The receiver must be set up properly for the satellite you wish to find & track. These receiver settings should be saved to expedite finding, or re-acquiring, the desired satellite in the future.

When searching for a desired satellite, this receiver compares any satellite ID it finds to the saved satellite ID code. If the ID code does not match the antenna will continue searching until the correct satellite is found. The system must have adequate satellite signal level, AND the matching ID, to stop searching (and continue tracking the desired satellite).

If you have the optional Touch Screen Controller (TSC-10) you can setup multiple "favorite satellites" and subsequently switch to different "favorite" satellite with two touches on the main (home) screen.

3.2.7. Tracking

The DTV04 HD antenna actively optimizes the pointing of the dish for maximum signal reception. This process is called tracking and is accomplished by continuously making small movements of the dish while monitoring the level of the received signal from DIRECTV at 101°W. Evaluation of this information is used to continuously make minor pointing corrections to keep the signal level “peaked” as part of normal operation.

3.2.8. Unwrap

Mechanical stops limit the azimuth rotation to a total of 690 degrees. The mechanical stops are at Relative 020.0 and 700.0. When the azimuth rotation is within 3 degrees of either mechanical stop, the antenna will be driven 360 degrees away from that stop. This “Unwraps” (unwinds) the cables that are routed through the pedestal assembly so that they do not become too severely twisted. It also repositions the antenna to a point which is closer to the middle of its mechanical stops. UNWRAP should occur when the Relative position of the antenna is at 023.0 or 697.0.

By rotating 360 degrees the azimuth position of the antenna will have returned to the previous Azimuth position and will resume tracking the desired satellite. Unwrap will occur whenever the boat has turned far enough in one direction for it to be required. It is normal for the satellite signal to be lost, and the television picture to “freeze frame”, until the antenna completes unwrap and resumes tracking the satellite.

The following text provides a basic functional overview of the system components and component interconnection as referred to in the simplified block diagram below. Also, refer to the appropriate page of the System Block Diagram which depicts your system configuration for further detail.



3-6

3.3.1. Antenna ADE Assembly

The Above Decks Equipment consists of an Antenna Pedestal inside a Radome assembly. The pedestal consists of a DIRECTV Slimline antenna dish & feed with 5 circular Low Noise Block converter (LNBFs) with a reflector skew motor mounted on a stabilized antenna pedestal. The radome provides an environmental enclosure for the antenna pedestal assembly inside it. This keeps wind, water condensation and salt-water spray off the antenna pedestal assembly. This prevents damage and corrosion that would shorten the expected life span of the equipment.

The antenna control coax cable is connected between the antenna radome assembly and the antenna control unit. This cable provides DC voltage to the antenna and all control signals to and from the antenna.

Five other RG-6 (or better) coax cables are installed from the antenna radome assembly to the below decks equipment. These four cables carry the intermediate frequency (950-1450MHz for Ku-Band Converted Frequencies, 250-750MHz and 1650-2150MHz for Ka-Band Converted Frequencies) signals from the antenna assembly directly to the DIRECTV 5LNB compatible active matrix switch as well as the DC Voltage & Tone switching from the Matrix Switch to the LNB. The Fifth coax installed is intended as a spare.

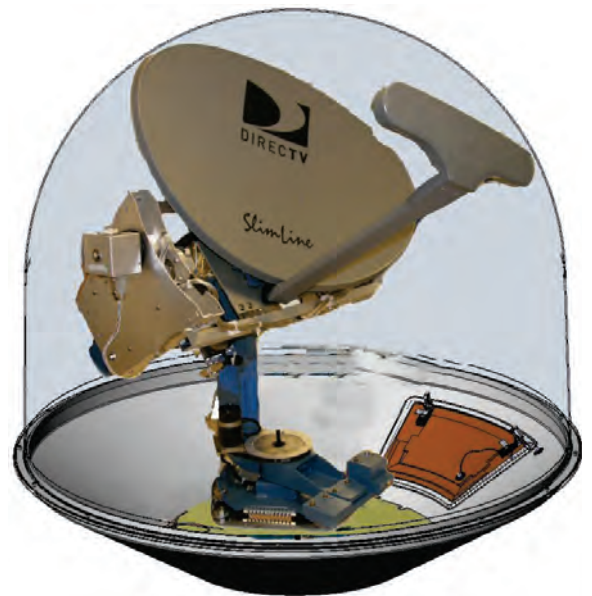


Figure 3-9 DTV04 HD Above Decks Equipment

3.3.2. Antenna Control Unit

The Antenna Control Unit allows the operator to control and monitor the antenna pedestal with dedicated function buttons, LED's and a 2 line display. The ACU and its Terminal Mounting Strip are normally mounted in a standard 19" equipment rack. The ACU should be mounted in the front of the equipment rack where it is easily accessible. The Terminal Mounting Strip is normally mounted on the rear of the equipment rack. It is recommended that the antenna control panel be mounted near one of the Satellite Receiver locations where you can see the television screen while you are controlling the antenna.

The Antenna Control Unit is connected to the antenna, ships Gyro Compass and to the optional Touch Screen Controller (when included).

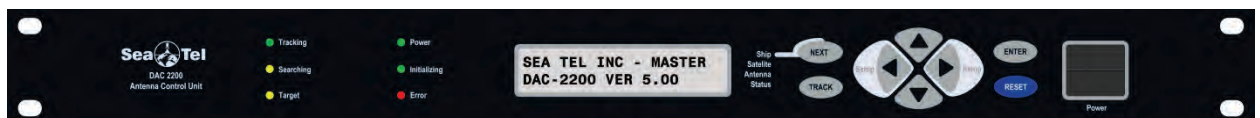


Figure 3-10 DAC-2200 Antenna Control Unit

The Antenna Control Unit (ACU) communicates via an 70/120 KHz full duplex data link with the Pedestal Control Unit (PCU) located on the antenna. This control signal is sent up the Antenna Control Coax cable along with the DC voltage for the antenna power. The Pedestal Control Unit stabilizes the antenna against the ship's roll, pitch, and turning motions. The ACU is the operator interface to the PCU and provides the user with a choice of positioning commands to point the antenna, search commands to find the satellite signal and tracking functions to maintain optimum pointing.

3.3.3. Power Supply

AC Voltage - An appropriate source of AC Voltage (preferably from a **Uninterrupted Power Supply**) will also be required for the ACU, satellite receivers and television monitors. Refer to the manuals for these devices for voltage and power consumption of each. Total power consumption will depend on the number of satellite receivers and television monitors used.

3.3.4. Satellite Receivers

The DTV04 HD Antenna system is designed to be used with DIRECTV compatible satellite receivers. When authorized, the satellite receiver will decode the encrypted signals and provide the audio visual output for your installed televisions(s). Authorizing the receiver-decoder is a process of registering your receiver(s) and paying subscription fees to the service provider (DIRECTV Satellite Television®). The service provider then arranges for a signal to be sent through the satellite to your receiver-decoder, which will “enable” it to decode the programming you subscribed to.

A coax connection from the antenna (via the matrix switch) provides signal input to the receiver. The receiver also outputs voltage and tone control to the matrix switch to select the correct satellite and polarization signal for the channel you want to watch.

3.3.5. Television/Monitor

An appropriate television monitor is used to view the satellite television programming and the on screen displays from the receiver. Your television/monitor must be able to display the video standard outputted from the satellite receiver. Consult your Television/Monitor manual for specifics.

3.3.6. Matrix Switch

The DTV04 HD Antenna system requires a Multiswitch which is compatible with the DIRECTV Slimline 5 LNB Feed assembly. This Matrix Switch routes the satellite signal from one of the IF cables to one of your receivers. As you change channels on the satellite receiver, it uses the voltage, and/or tone, to select the correct signal input for the channel you have selected.

Each output of the matrix switch is controlled by voltage, and/or tone, from the satellite receiver connected to that output connector. The combination of Voltage level and a sensed 22KHz tone selects which satellite and polarity is provided to that receiver. Each output of the matrix switch operates independently of the others, therefore allowing the satellite receivers to operate independent of each other.

The matrix switch is normally installed with the Below Decks Equipment. IF coax cables are connected from the LNB inputs to the Multiswitch inputs and then a coax cable (RG-6 OR greater) is connected from one of its outputs to each satellite receiver. One of these outputs must be connected to the tracking receiver in the DAC2202. Multiswitch's are available at the time of purchase from Sea Tel for 12 outputs (SMS 41209 WBP Sea Tel P/N 130010-1) for support of up to 11 receivers and 16 outputs (SMS 41609 WBP Sea Tel P/N 130010-2) for support of up to 15 receivers. Contact the Sea Tel Service department for distribution of >15 receivers.

4. Installation

Below are basic steps to guide you in installing this equipment, but you may choose to complete the installation steps in a different order. Read this complete section before starting. Installation of the DAC-2202 Antenna Control Unit may have already have been performed using its Installation and Operation manual instructions. The following instructions describe the installation procedures for installing the Series 04 Antenna (ADE).

4.1. General Cautions & Warnings



CAUTION - Allow only an **authorized dealer** to install or service the your Sea Tel Television Receive Only System components. Unauthorized installation or service can be dangerous and can invalidate the warranty.



WARNING: Assure that all nut & bolt assemblies are tightened according the tightening torque values listed below:

Bolt Size	Inch Pounds
1/4-20	75
5/16-18	132
7/16-14	376
1/2-13	517



NOTE: All nuts and bolts should be assembled using the appropriate Loctite thread-locker product number for the thread size of the hardware.

Loctite #	Description
222	Low strength for small fasteners.
243	Medium strength, oil tolerant.
262	Permanent strength for up to 3/4" diameter fasteners.
271	Permanent strength for up to 1" diameter fasteners.
290	Wicking, High strength for fasteners which are already assembled.

4.2. Site Survey

The site survey is performed to decide where the best location for the equipment to be installed is. The radome assembly (ADE) should be installed at a location aboard ship where:

1. The antenna has a clear line-of-sight to as much of the sky (horizon to zenith at all bearings) as is practical.
2. The antenna is a minimum of 15 feet from the ship's radar, especially high power radar arrays.
3. The antenna is not mounted on the same plane as the ship's radar, so that it is not directly in the radar beam path.
4. The antenna is a minimum of 15 Feet from high power short wave transmitting antennas are not in close proximity.
5. The antenna must be installed in a rigid mounting location that will not flex, or sway, in ship's motion or vibration.
6. The Above Decks Equipment (ADE) and the Below Decks Equipment (BDE) should be positioned as close to one another as possible. This is necessary to reduce the losses associated with long cable runs.

If these conditions cannot be entirely satisfied, the site selection will inevitably be a “best” compromise between the various considerations. However, the warranty of the antenna will not cover physical or electrical (RF) damage of the antenna due to the compromised location.

4.3. Preparing For The Installation

4.3.1. Unpack Shipping Crates

Exercise caution when unpacking the equipment crate(s). Carefully inspect the radome surface for evidence of shipping damage.

4.3.2. Installing The Cables

Install appropriate cables from ADE to the BDE Location. Exercise caution during the cable installation to assure that the cables are not severely bent (proper bend radius) or twisted and that connectors are not damaged. Ensure that the cables have been run through watertight fittings and/or will not permit water entry into the boat when the installation is completed.

4.4. Preparing the ADE for Lift

	WARNING: Hoisting with other than a webbed four-part sling may result in catastrophic crushing of the radome. Refer to the specifications and drawings for the fully assembled weight of your model Antenna/Radome and assure that equipment used to lift/hoist this system is rated accordingly.
	CAUTION: The antenna/radome assembly is very light for its size and is subject to large swaying motions if hoisted under windy conditions. Always ensure that tag lines, attached to the radome base frame, are attended while the antenna assembly is being hoisted to its assigned location aboard ship.

1. The antenna pedestal is shipped completely assembled in its radome.
2. Remove the shipping nuts which mount the ADE to the pallet.
3. Attach a four part web strap lifting sling to the four lifting pad eyes on the radome lip.
4. Using the web strap lifting sling arrangement, and with a tag line attached near the radome base, hoist the antenna assembly to its assigned location aboard the ship by means of a suitably sized crane or derrick.
5. The radome assembly should be positioned with the BOW marker aligned as close as possible to the centerline of the ship. Small variations from actual alignment can be compensated with the AZIMUTH TRIM adjustment in the ACU, so precise alignment is not required.
6. Bolt the radome base directly to the ship's deck or mounting plate (flat mounting area).

4.5. Antenna Pedestal Mechanical Checks

1. Open the radome hatch, or remove the top, to access the antenna pedestal.
2. Inspect the pedestal assembly and reflector for signs of shipping damage.
3. Remove the web strap shipping restraints from the pedestal. Save these straps to restrain the antenna in the event that the AC power will be turned off while the ship is underway.
4. Cut and discard the large white tie-wraps from the pedestal.
5. Using a 7/16" wrench, remove the Red shipping bar restraining the cross-level axis.
6. Check that the antenna moves freely in azimuth, elevation, and cross level without hitting any area of the interior of the radome.
7. Check that the antenna assembly is balanced front to back, top to bottom and side to side by observing that it remains stationary when positioned in any orientation. (Refer to the maintenance section of this manual for complete information on balancing the antenna).
8. Check that all pedestal wiring and cabling is properly dressed and clamped in place.
9. See cable terminations section below.

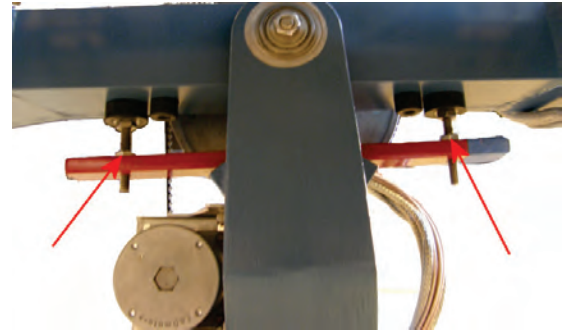


Figure 11 Cross-Level Shipping Restraint

4.6. Cable Terminations



CAUTION: Rough handling, tight bending, kinking, crushing and other careless handling of the cables and their connectors can cause severe damage.

The cables must be routed from the above-decks equipment group through the deck and through various ship spaces to the below-decks equipment group. When pulling the cables in place, avoid sharp bends, kinking, and the use of excessive force. After placement, seal the deck penetration gland and tie the cables securely in place.

4.6.1. At The Radome

The coax cables must be inserted through the cable strain relief(s) at the base of the radome. Apply RTV to the strain relief joints and tighten the compression fittings to make them watertight. The cables are color coded for easy connection identification. (Refer to the System Block Diagram for cable color assignment).

4.7. Final Checks

Double check all your work and do a good visual inspection. Rotate the antenna in azimuth to assure rotation is free and there is no binding or fouling in the cables you installed. Rotate the antenna in elevation and Cross-Level to assure that the pedestal moves freely and that there is no binding.

4.8. Power-Up – Observe the Antenna

When all the hardware and cables have been installed, have someone turn the ACU power ON. This will energize the antenna and it will begin **Initialization**. Observe initialization of the antenna to verify that each phase of the initialization is completed satisfactorily (refer to Initialization Sequence in the Maintenance section of this manual).

Close and fasten the radome hatch. Assure that the radome hatch is closed and secured when entry into the radome is no longer required.

4.9. Setup

Refer to the Setup information in the next section of this manual. Also refer to the Setup instructions the Antenna Control Unit manual to assure that the ACU settings and parameters are set correctly.

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5. Setup

Below are basic steps to guide you in setting up your system. Assure that the Antenna Pedestal (ADE) has been properly installed before proceeding.

5.1. Initial Setup

Your system has been delivered with all adjustable system parameters set to values which were sufficient for factor testing only. It is **expected** as part of commissioning that some of these parameters be adjusted or "Optimized" for each specific installation. As a starting point access the SETUP parameters and adjust the parameters as required to reflect the values in the "Default Setup Parameters Table". If required refer to the Operation chapter of the DAC2202 manual for detailed information on parameter descriptions and value entry.

5.2. Default Setup Parameters – DTV04 HD Antenna System

The following table shows the factory default parameters for the DAC-2202 interfaced to a DTV04 HD Antenna. When the installation & setup of your system is finished you should record the "optimized" settings for your system in the "My Parameters" column. Refer to the Setup Flow-Charts and individual parameter setting information in the Setup section of your DAC-2202 manual for how to enter/change the parameters.

 **The Factory Default parameters listed below are values that were required for initial system testing only. You are required to optimize these settings for each installation. System failures that have been determined to be due to improper value settings for these parameters will not be covered under warranty.**

PARAMETER	Factory Default	My Parameters
EL TRIM	0	
AZ TRIM	0	
AUTO THRES	100	
EL STEP SIZE	0	0*
AZ STEP SIZE	0	0*
STEP INTEGRAL	0	0*
SEARCH INC	10	
SEARCH LIMIT	100	
SEARCH DELAY	30	
SWEEP INC	0080	
SYSTEM TYPE	77	
GYRO TYPE	0002	
POL TYPE	72	72*
POL OFFSET	30	
POL SCALE	80	80*
AZ LIMIT 1	0	
AZ LIMIT 2	0	
EL LIMIT 12	90	
AZ LIMIT 3	0	

AZ LIMIT 4	0	
EL LIMIT 34	90	
AZ LIMIT 5	0	
AZ LIMIT 6	0	
EL LIMIT 56	90	
AZ LIMIT 7	0	
AZ LIMIT 8	0	
EL LIMIT 78	90	
TX POLARITY	2	2*
TRACK DISP	0000	0000*

* Do NOT adjust these parameters to any other values than that from factory default.

5.3. Optimize Targeting

The process calibrates the antenna's reference to True North for Azimuth (000.0°) and Horizon for Elevation (00.0) pointing angles of the reflector to ensure proper Az, EL, and/or Satellite targeting. The following procedure describes in detail the process of first locating and identifying satellite 101W, then calculating and entering proper Azimuth and Elevation Trim Values. When completed, record the optimized TRIM settings in the "My Parameters" column of the default parameters setup table.

Before beginning it is necessary to know some information pertaining to the satellite 101°W.

Obtain and record satellite parameters:

- **IF Tracking Frequency:** _____
This value is calculated by using the Satellite Transponder Downlink Frequency and subtracting the LNB Local Oscillator Frequency (RF-LO = IF)
- **Baud Rate:** _____
This value is the received transponder Symbol Rate (referenced as "SR" on Lyngsat.com and SatcoDX)
- **Volt:** _____
This value is determined by received downlink frequency polarization type, Options are:
 LHCP Left Hand Circular Polarization (18Vdc output receiver voltage if enabled)
 RHCP Right Hand Circular Polarization (13Vdc output receiver voltage if enabled)
- **FEC:** _____
This value is the received transponder Forward Error Correction rate
- **Tone:** _____
This parameter turns ON or turns OFF a 22Khz tone output from DVB receiver for Band Selection
- **NID:** FFFE (known value)
This parameter is the Network Identification of the received transponder. It can be determined by converting the decimal NID as listed on Lyngsat.com and SatcoDX to Hexadecimal. **Note that not all services broadcast a discrete NID, such as DirecTV DSS service. In these cases a Pseudo NID can be produced based on matching IF, Baud Rate, and FEC rate, thus the known **FFFE** NID.

1. On the DAC2202 press the **NEXT** **NEXT** arrow key until Ship window is displayed. _____ □
2. Verify the displayed Lat and Lon values reflect current vessel position. _____ □
3. Verify the displayed heading value(s) reflect current vessel orientation. _____ □
4. Press the **NEXT** **NEXT** arrow key until Sat window is displayed. _____ □
5. Press the **ENTER** **ENTER** arrow key to isolate 'FREQ' in the bottom left hand corner of screen. ____ □

6. Use the  **LEFT & RIGHT** arrow keys to select appropriate digits then use the  **'UP & DOWN'** arrow keys to change value to the "IF Tracking Frequency" recorded above. _____ ☐
7. Press the  **ENTER** arrow key to submit value to RAM. _____ ☐
8. Press the  **ENTER** arrow key to move down in receiver selection to BAUD and change value in same manner as in Step 6 to the "Baud Rate" recorded above. _____ ☐
9. Press the  **ENTER** arrow key to move down in receiver selection to TONE. _____ ☐
10. Use the  **LEFT** arrow key to select parameter and use the  **'UP & DOWN'** arrow keys to change tone state on/off value to the "TONE" state recorded above. _____ ☐
11. Press the  **ENTER** key to submit to RAM. _____ ☐
12. Press the  **ENTER** key to move down in receiver selection to Volt. _____ ☐
13. Use the  **LEFT** arrow key to select parameter and use the  **'UP & DOWN'** arrow keys to change value to the "Volt" recorded above. _____ ☐
14. Press  **ENTER** key to submit to RAM. _____ ☐
15. Press the  **ENTER** arrow key to move down in receiver selection to FEC. _____ ☐
16. Use the  **LEFT** arrow key to select parameter and use the  **'UP & DOWN'** arrow keys to change Forward Error Correction value to the "FEC" recorded above. _____ ☐
17. Press the  **ENTER** arrow key to submit to RAM. _____ ☐
18. Press the  **ENTER** arrow key to move down in receiver selection to NID and use the  **'UP & DOWN'** arrow keys to change NID value to FFFE. _____ ☐
19. Press the  **ENTER** arrow key to isolate 'SAT' in the upper left-hand corner of screen. _____ ☐
20. Use the  **LEFT & RIGHT** arrow keys to select appropriate digits then use the  **'UP & DOWN'** arrow keys to change value to read 101W. _____ ☐
21. Press the  **ENTER** key and observe the Targeting LED on the DAC2202 front panel. _____ ☐
22. When the Targeting LED turns off, press the  **TRACK** key. _____ ☐
23. Press the  **NEXT** arrow key until 'SAT' window is displayed and record THRS (Threshold) value _____ ☐
24. Press the  **NEXT** arrow key until Antenna window is displayed. _____ ☐
25. Record targeted AZ and EL position values.
AZ _____ EL _____ ☐

26. Press either of the  **LEFT** & **RIGHT** arrow keys to skew antenna in azimuth to bring displayed AGC to any value above the threshold value recorded in Step 23. _____ □

 **LEFT** arrow key drives antenna CCW (decrements AZ value)

 **RIGHT** arrow key drives antenna CW (increments AZ value)

27. With AGC value above threshold, Press the  **TRACK** key to enable tracking. _____ □

28. Press the  **NEXT** arrow key until 'SAT' window is displayed and verify decoded NID of FFFE is displayed in the bottom right hand side of the screen. _____ □



If the displayed NID is any other value then FFFE, turn tracking off, and resume azimuth sweeps until 101W is properly identified.

29. Press the  **NEXT** arrow key until Antenna window is displayed. _____ □

30. Record On-Sat AZ and EL position values.

AZ _____ EL _____ □

31. Using the DIRECTV satellite receiver verify signal strength on both even and odd transponders (Refer to satellite receiver manual for instructions). _____ □

32. Calculate the required **AZ TRIM** parameter:

If the On-Sat Az value is less than the calculated Az value:

33. Subtract targeted AZ value recorded in Step 30 from Calculated Az value recorded in step 25, multiply by 10 and record the required AZ TRIM parameter _____ □

Example: Calculated AZ 180.0, On-Sat AZ 176.2 $(180.0 - 176.2) * 10 = \text{Az Trim value of } 0038$

If the On-Sat Az value is greater than the calculated Az value:

34. Subtract Calculated AZ value recorded in Step 25 from Calculated Az value recorded in step 30, multiply by a negative 10 and record the required AZ TRIM parameter _____ □

Example: Calculated AZ 180.0, On-Sat AZ 186.2 $(186.2 - 180.0) * -10 = -0062$ for an Az Trim value of -0038

35. Calculate the required **EL TRIM** parameter:

If the On-Sat EL value is less than the calculated EL value:

36. Subtract targeted EL value recorded in Step 30 from Calculated EL value recorded in step 25, multiply by 10 and record the required AZ TRIM parameter _____ □

Example: Calculated EL 45.0, On-Sat EL 43.5 $(45.0 - 43.5) * 10 = \text{EL Trim value of } 0015$

If the On-Sat EL value is greater than the calculated EL value:

37. Subtract Calculated EL value recorded in Step 25 from Calculated EL value recorded in step 30, multiply by a negative 10 and record the required AZ TRIM parameter _____ □

Example: Calculated EL 45.0, On-Sat EL 46.5 $(46.5 - 45.0) * -10 = -0015$ for an EL Trim value of -0038

38. Press the   **LEFT & RIGHT** arrow keys simultaneously for 6 seconds to access the setup mode parameters menu. _____ □

39. Use the   **LEFT & RIGHT** arrow keys to select appropriate digits then use the  **'UP & DOWN'** arrow keys to change **EL TRIM** parameter to value recorded in Step 33. (Pressing the Down arrow key from 0000 will cause numbers to go negative) _____ □

40. Press the  **ENTER** arrow key to submit to RAM. _____ □

41. Press the  **ENTER** arrow key to display **AZ TRIM**. _____ □

42. Use the  **LEFT** & **RIGHT** arrow keys to select appropriate digits then use the  **'UP & DOWN'** arrow keys to change **EL TRIM** parameter to value recorded in Step 33. (Pressing the Down arrow key from 0000 will cause numbers to go negative) _____ ☐
43. Press the  **ENTER** arrow key to submit to RAM. _____ ☐
44. Quickly press and release both the  **LEFT** & **RIGHT** arrow keys. _____ ☐
45. Display should now read **"SAVE NEW PARAMETERS"**. _____ ☐
46. Press the  **LEFT** arrow key to select parameter. _____ ☐
47. Press the  **ENTER** key and verify displays now reads **"PARAMETERS SAVED"**. _____ ☐

5.4. Reflector Skew

In addition to full 3 axis stabilization (Azimuth, Elevation and Cross-Level), your system is fitted with the required hardware and software to drive the reflector skew angle so that the LNBF assembly properly aligns with all 5 DIRECTV satellites. This skew angle (displayed as POL xxxx) is sub menu viewed on under the Antenna Main Menu.



Once properly calibrated the function of adjusting reflector skew is an automatic function of the ACU, provided the POL TYPE parameter is set to 72 (Auto SKEW Mode) based on the vessel's geographic location.

1. Verify antenna is tracking satellite 101°W with a decoded NID of FFFE. _____ ☐
2. Using the satellite receiver, record the signal strength for satellite 101°W. _____ ☐
3. Access the **POL OFFSET** parameter in the DAC2202 and either increment or decrement the current displayed value as required to achieve maximum receive signal strength for an odd transponder on satellite 119°W. _____ ☐
4. Using the satellite receiver, verify the signal strength reading for satellite 101° has not changed from the value recorded in step 2. _____ ☐
5. Access the **"SAVE NEW PARAMETERS"** selection in the DAC2202. _____ ☐
6. Press the **RIGHT** arrow, then press **"ENTER"** _____ ☐
7. Verify **"PARAMETERS SAVED"** is displayed on front panel. _____ ☐

5.5. Blockage Mapping

Your system can be programmed to define up to 4 relative zones, where there are known blockage regions. Tracking and auto Search features are automatically suspended when the antenna is pointed within this specified region to assure it maintains its' pointing angle to 101W. As the ship turns in heading and the antenna comes out of the blockage zone there should be an immediate acquisition of the satellite. BLOCKED status is displayed in the TRACKING window. In addition this feature enables to define Elevation Blockage limits per zone. Calculate and enter the required blockage zones for this installation. See the DAC2202 Antenna Control Unit manual for more detailed information and parameter entry instructions.

5.5.1. Pointing Angles Reference Chart

For Targeting purposes, your system will calculate the Azimuth (referenced to True North), Elevation (referenced to horizon), and Reflector Skew (referenced to horizon) angles based on the vessels current latitude & longitude and the satellite located at 101°W every time the system sends a target command. The following chart is intended as a quick reference for those angles. It also includes an area for you to enter your most commonly visited port locations.

Major Cities West Coast (North to South)					
City	Latitude	Longitude	Azimuth	Elevation	Reflector Skew
Seattle	47.39°N	122.18°W	152.2	31.8	94
Portland	45.32°N	122.36°W	151.2	33.7	92
Eureka	40.59°N	124.6°W	146.1	37.2	88
San Francisco	37.37°N	122.23°W	147.4	41.3	87
Los Angeles	33.4°N	118.14°W	150.7	47	89
San Diego	32.44°N	117.1°W	151.7	48.4	89
Major Cities Gulf Coast (West to East)					
Brownsville	25.54°N	97.26°W	188.6	59.9	117
Corpus Christi	27.46°N	97.3°W	188	57.7	116
Houston	29.59°N	95.22°W	191.6	54.9	119
New Orleans	29.59°N	90.15°W	201.2	53.5	126
Biloxi	30.25°N	88.55°W	203.7	52.2	128
Mobile	30.41°N	88.15°W	204.3	51.9	128
Tampa	27.58°N	82.32°W	216.1	51.7	138
Fort Myers	26.35°N	81.52°W	218.6	52.4	140
Major Cities East Coast (South to North)					
Key West	25.47°N	81.68°W	219.2	53.2	141
Miami	25.47°N	80.17°W	221.5	52.2	143
Ft. Lauderdale	26.4°N	80.17°W	220.6	51.4	142
Jacksonville	30.3°N	81.42°W	215.2	48.7	137
Savannah	32.8°N	81.12°W	213.7	46.2	135
Charleston	32.54°N	80.2°W	215.2	46	136
Myrtle Beach	33.68°N	78.93°W	216.2	44.2	136
Wilmington	34.16°N	77.55°W	217.7	43	137
Norfolk	36.54°N	76.12°W	217.9	40.2	136
Atlantic City	39.23°N	74.26°W	218.5	36.8	136
New York	40.46°N	73.54°W	218.7	35.4	135
Providence	41.44°N	71.26°W	220.8	33.4	136
Boston	42.22°N	71.2°W	220.4	32.7	136
Bangor	44.48°N	68.5°W	222.3	29.4	135

City	Latitude	Longitude	Azimuth	Elevation	Reflector Skew
Rochester	43.7°N	77.4°W	212.3	34.3	130
Buffalo	42.56°N	78.44°W	211.6	35.8	130
Cleveland	41.24°N	81.51°W	240.6	21.1	129
Detroit	42.25°N	83.1°W	205.7	37.9	127
Chicago	41.47°N	87.45°W	200	40.1	123
Green Bay	44.29°N	88.8°W	197.2	37.5	121
Duluth	46.5°N	92.11°W	192.2	35.8	117

[illegible]

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6. Functional Testing

If not already ON, Turn ON the Power switch on the front panel of the ACU.

6.1. (OPTIONAL) TSC-10 Touch Screen Controller Checks

Refer to the functional testing chapter of the TSC-10A manual for check to perform.

6.2. ACU / Antenna System Check

1. Press RESET on the ACU front panel to initialize the system. Verify the display shows "SEA TEL INC - MASTER" and the ACU software version number. Wait 10 seconds for the display to change to "SEA TEL INC - REMOTE" and the PCU software version number. If the display shows "REMOTE INITIALIZING", wait approximately 2 minutes for the antenna to complete initialization and report the Antenna Model and PCU software version. If "REMOTE NOT RESPONDING" is displayed, refer to the Troubleshooting Section of this manual.
2. Press the **NEXT** key repeatedly to display the **Ship**, **Satellite**, **Antenna** and **Status** menu displays. This verifies that the displays change in the correct response to the keys.

6.3. Latitude/Longitude Auto-Update check

This verifies that the GPS antenna mounted on the antenna pedestal is automatically updating the current ship's position information. If the GPS is not updating the ACU properly, refer to the Troubleshooting Section of this manual.

1. Press the **NEXT** key repeatedly to display the **Ship** menu. Press **ENTER** to access edit mode and view the current Latitude value.
2. Press the **LEFT** arrow key to bring the cursor up under the ones digit, press **UP** and then hit **ENTER**. The display should immediately show a latitude value one degree higher. If the GPS engine mounted on the Antenna Pedestal is working properly the incorrect value will be overwritten within several seconds (back to the correct current value).
3. This test does not need to be repeated in the Longitude menu.

6.4. Azimuth & Elevation Drive

This check verifies that the antenna moves in the correct direction in response to the keys. If the antenna is not driving properly, refer to the Troubleshooting Section of this manual.

1. Press the **NEXT** key several times to display the **Antenna** menu.
2. Press the **Tracking** key to toggle Tracking OFF.
3. Press the **UP** arrow key repeatedly and verify that the antenna moves up in elevation.
4. Press the **DOWN** arrow key repeatedly and verify that the antenna moves down in elevation.
5. Press the **RIGHT** arrow key repeatedly and verify that the antenna moves up in azimuth.
6. Press the **LEFT** arrow key repeatedly and verify that the antenna moves down in azimuth.

6.5. Four Quadrant Tracking Test

The 4 Quadrant Tracking Test is one of the best tests that can be performed on any Sea Tel 3-axis antenna. It verifies good antenna operation including antenna drive, ACU receiver operation, and tracking operation. This procedure explains the process of and is **HIGHLY RECOMMENDED** that this test be performed on **ALL** antennas that you work on.

Step 1: Ensure the tracking receiver parameters are set correctly and that antenna is tracking satellite 101°W, peaked signal (maximum AGC level above threshold) with a decoded NID of FFEE.
 Record the on Satellite AGC level _____
 Record the on Satellite AZ position _____
 Record the on Satellite EL position _____

Step 2: Turn tracking off by pressing the  **TRACK** key. Ensure the Tracking LED is no longer illuminated.

Step 3: Drive Azimuth down until displayed AGC falls approx. 2-3dB (Do not drive antenna so far that AGC falls below threshold)

1. Press the  **NEXT** arrow key until Antenna window is displayed
2. Press the  **RIGHT** arrow key until AGC reduces approx. 100 to 300 AGC counts (With DacRemP's ADMC graph chart running drive antenna down in Azimuth until AGC falls approx. 3-4 divisions.)

Step 4: Re-enable tracking and time it takes to get back to peak

1. Press the  **NEXT** arrow key until Antenna window is displayed
2. Press the  **ENTER** arrow key to isolate AZ and AGC (El and Rel not displayed)
3. Press the  **TRACK** key to toggle tracking to enable tracking.
4. Time the amount of seconds it takes AGC value takes time to get back to peak as recorded in Step 1. (If using DacRemP, each time division equals 8 seconds.)

**** Nominal time to get back to peak is 8-30 seconds** You should also be able to observe the DishScan tracking decisions being carried out by ACU by viewing either a 2, 4, 6, or 8 in the bottom left-hand side of the screen. A normal displayed response would be opposite than that of the axis driven, i.e. for an antenna driven up (CW) is azimuth you would expect to see a majority of 4's being displayed indicating DishScan senses signal strength higher down in azimuth, therefore sending the Azimuth Down command to PCU.

A flashing '2' indicates an Elevation Down command
 A flashing '8' indicates an Elevation Up command
 A flashing '4' indicates an Azimuth Down (CCW) command
 A flashing '6' indicates an Azimuth Up (CW) command
 A flashing '0' indicates No antenna drive command

5. Verify AGC, AZ, and EL go back to original positions recorded in Step 1.

Step 5: Repeat steps 2-4 driving antenna the other 3 drive directions

Using the  **LEFT** arrow to drive antenna down (CCW) in Azimuth

Using the  **DOWN** arrow key to drive antenna down in Elevation

Using the  **UP** arrow key to drive antenna up in Elevation

7. Troubleshooting and Maintenance

This section describes the theory of operation to aid in troubleshooting and adjustments of the antenna system. Refer to the Trouble shooting section of the DAC-2202 for additional troubleshooting details.

7.1. **Warranty Information**

Sea Tel Inc. supports its DTV04 HD Antenna systems with a **2 YEAR** warranty period on parts and **1YEAR** warranty period on labor.

What's Covered by the Limited Warranty?

The Sea Tel DTV04 HD Limited Warranty is applicable for parts and labor coverage to the complete antenna system, including all above-decks equipment (radome, pedestal, antenna, motors, electronics, wiring, etc.) and the Antenna Control Unit (ACU).

What's **NOT** Covered by the Limited Warranty?

It does **not** include Television sets, DBS/DTH receivers, multi-switches or other distribution equipment, whether or not supplied by Sea Tel commonly used in TVRO Systems. Televisions, DBS/DTH receivers and accessories are covered by the applicable warranties of the respective manufacturers.

Factory refurbished components used to replace systems parts under this warranty are covered by this same warranty as the original equipment for the balance of the original warranty term, or ninety (90) days from the date of replacement, whichever occurs last. Original Installation of the DTV04 HD system must be accomplished by or under the supervision of an authorized Sea Tel dealer for the Sea Tel Limited Warranty to be valid and in force.

Should technical assistance be required to repair your system, the first contact should be to the agent/dealer you purchased the equipment from.

Please refer to the complete warranty information included with your system.

7.2. **Recommended Preventive Maintenance**

Ensure that all of the normal operating settings (LAT, LON, HDG, SAT and all of the Tracking Receiver settings) are set correctly. Refer to the Functional Testing section of this manual for instructions to conduct the tests below.

7.2.1. **Check ACU Parameters**

Assure that the parameters are set correctly (you may wish to record them in the Factory Default Settings, in section 5 of this manual).

7.2.2. **Latitude/Longitude Auto-Update check**

Refer to the Latitude & Longitude Update check procedure in the Functional Testing section of this manual.

7.2.3. **Heading Following**

Refer to the Heading Following verification procedure in the Functional Testing section of this manual.

7.2.4. **Azimuth & Elevation Drive**

Refer to the Azimuth & Elevation Drive check procedure in the Functional Testing section of this manual.

7.2.5. **Test Tracking**

Refer to the four quadrant Tracking check procedure in the Functional Testing section of this manual.

7.2.6. **Visual Inspection - Radome & Pedestal**

Conduct a good, thorough, visual inspection of the radome and antenna pedestal. Visually inspect the inside surface of the radome top and of the antenna pedestal. Look for water or condensation, rust or corrosion, white fiberglass powder residue, loose wiring connections, loose hardware, loose or broken belts or any other signs of wear or damage.

1. Radome Inspection - The radome top/bottom flanges are properly sealed to prevent wind, saltwater spray and rain from being able to enter the radome. Re-seal any open ("leaky") areas with marine approved silicone sealant. If heavy condensation, or standing water, is found inside the radome, isolate and seal the source of the leak, and then dry out the radome. Small (1/8 inch) holes may be drilled in the recesses of the base pan of the radome to allow standing water to "weep" out.
2. Antenna Pedestal Inspection - The springs (or rubber vibration dampeners) should not be completely compressed, or otherwise damaged. The plated and painted parts should not be rusted or corroded. The harnesses should not be frayed and all the connectors should be properly fastened and tightened. All hardware should be tight (no loose assemblies or counter-weights). Replace, re-coat, repair and/or tighten as necessary.

7.2.7. Mechanical Checks

Turn the antenna control unit OFF

1. Inspect inside of radome for signs that the dish or feed have been rubbing against the inside of the fiberglass radome.
2. Rotate the pedestal through its full range of azimuth motion. The antenna should rotate freely and easily with light finger pressure.
3. Rotate the pedestal through full range of elevation rotation. The antenna should rotate freely and easily with light finger pressure.
4. Tilt the pedestal through full range of left-right cross-level rotation. The antenna should rotate freely and easily with light finger pressure.
5. Rotate the level cage through the full 90 degrees of rotation from CCW stop to CW stop.
6. Inspect all drive belts for wear (black dust on/under the area of the belt).

7.2.8. Check Balance

Check the balance of the antenna, re-balance as needed (refer to the Balancing the Antenna procedure below).

7.2.9. Observe Antenna Initialization

Observe the Antenna Initialization as described in the Troubleshooting section below.

7.2.10. Check ACU Parameters

Assure that the parameters are set correctly (you may wish to record them in the Factory Default Settings, in section 5 of this manual).

7.3. Troubleshooting

Below are theory and diagnostic tests to assist you with troubleshooting the antenna. Refer to the previous section to check settings and do some initial functional testing prior to beginning troubleshooting.

7.3.1. Theory Of Stabilization Operation

The antenna system is mounted on a three axis stabilization assembly that provides free motion with 3 degrees of freedom. This assembly allows the inertia of the antenna system to hold the antenna pointed motionless in inertial space while the ship rolls, pitches and yaws beneath the assembly. Three low friction torque motors attached to each of the three free axes of the assembly provide the required force to overcome the disturbing torque imposed on the antenna system by cable restraints, bearing friction and small air currents within the radome. These motors are also used to re-position the antenna in azimuth and elevation.

The Pedestal Control Unit (PCU) uses inputs from the level cage sensors to calculate the amount of torque required in each axis to keep the antenna pointed within ± 0.5 degrees. The primary sensor input for each loop is the rate sensor mounted in the Level Cage Assembly. This sensor reports all motion of the antenna to the PCU. The PCU immediately responds by applying a torque in the opposite direction to the disturbance to bring the antenna back to its desired position. Both the instantaneous output of the rate sensor (Velocity Error) and the integrated output of the rate sensor (Position Error) are used to achieve the high pointing accuracy specification.

The calculated torque commands sent to each of three Brush-Less Servo Amplifiers. These amplifiers provide the proper drive polarities and commutation required to operate the Brush-Less DC Servo Motors in torque mode. The Torque acting on the mass of the antenna cause it to move, restoring the rate sensors to their original position, and closing the control loop.

Since the rate sensors only monitor motion and not absolute position, a second input is required in each axis as a long term reference to keep the antenna from slowly drifting in position. The Level and Cross Level reference is provided by a two axis tilt sensor in the level cage assembly. The Azimuth reference is provided by combining the ships gyro compass input and the antenna relative position.

7.3.2. Initialization Sequence

A functional operation check can be made on the antenna stabilization system by observing its behavior during the 4 phases of initialization.

Step 1. Turn on the AC power switch at the ACU front panel. Verify the level platform motor drives the level cage CCW to the stop and then CW 45 degrees.

Step 2. Verify the antenna moves forward or back to bring the top of the level cage to a level position in the for/aft direction. This step takes approximately 10 seconds and will result in the dish being at 45 degrees in elevation. The level cage may still be tilted left or right at this time.

Step 3. After the level cage is positioned in the for/aft direction, verify the antenna moves left or right to bring the top of the level cage to a level position in the left/right direction. This step takes approximately 10 seconds.

Step 4. After the level cage is positioned in the left/right direction, verify the antenna moves CW (up) in azimuth to the 700.0 degrees, and then down CCW to 630.0 Relative position. From this point on the Encoder will increment and/or decrement the Relative position of the antenna. The antenna will report the PCUs' Model number & Software version to the DAC-2202 ACU.

If any of these steps fail, or the DAC-2202 reports model number as "xx04", re-configure the PCU as described in section the Setup section of this manual.

7.3.3. Antenna Position Error Monitoring

The ACU provides a means for monitoring the position error of the antenna for diagnostic purposes. If this error is excessive, it indicates external forces are acting on the antenna. These forces may be the result of static imbalance, excessive bearing friction, cable binding, or wind loading.

- To view the position error, select the **REMOTE COMMAND** window on the ACU:
- Using the **LEFT/RIGHT** and **UP/DOWN** arrow keys set the Remote Command value to "**x0000**" (the x must be lower case) and press **ENTER**.
- Press **ENTER** key once more to display the **REMOTE MONITOR** window. The lower display will show "iv" and three 4 digit hex numbers (iv **FFFF 0001 FFFD**).

The numbers indicate Cross Level, Level and Azimuth errors at a resolution of 1 part in 65536 or 0.0055 degrees. For example a display like "iv FFFF 0001 FFFD" indicates the Cross Level error is - 0.005 degrees, the Level error is + 0.005 degrees and the Azimuth error is -0.016 degrees. The normal range of these numbers is FFF0 to 000F and they typically will bounce around randomly within this range.

7.3.4. Reference Sensor Testing

The ACU provides a means for monitoring the output of the 3 solid state rate sensors and the 3 reference sensors for diagnostic purposes. The rate sensors and reference sensors are the primary inputs to the PCU for stabilization.

To view the reference sensors, select the **REMOTE COMMAND** window on the ACU:

- Using the **LEFT/RIGHT** and **UP/DOWN** arrow keys set the Remote Command value to "**v0000**" (the v must be lower case) and press **ENTER**.
- Press **ENTER** key once more to display the **REMOTE MONITOR** window. The lower display will show "v" and three 4 digit decimal numbers (**v 1111 2222 3333**).

The numbers represent the Cross Level and Level Tilt Sensor outputs and the azimuth encoder respectively.

The Cross Level Tilt display should be 2048 when the level cage is level. It should decrease when the antenna is tilted to the left and increase when tilted to the right.

The Level tilt display should be 2048 when the level cage is level. It should decrease when the antenna is tilted forward (EL down) and increase when tilted back (EL up).

The Encoder display will show 2048 in the center of the mechanical range (Relative 360.0), decrease in value as the antenna is rotated counter-clockwise (down to about 0102 at lower stop) and increase in value as the antenna is rotated clockwise (up to about 3994 at upper stop).

7.3.5. Open Loop Rate Sensor Test

The ACU provides a means for monitoring the output of the 3 solid state rate sensors and the 3 reference sensors for diagnostic purposes. The rate sensors and reference sensors are the primary inputs to the PCU for stabilization.

- To monitor the rate sensors, select the **REMOTE COMMAND** window on the ACU:
- Using the **LEFT/RIGHT** and **UP/DOWN** arrow keys set the Remote Command value to "**w0000**" (the w must be lower case) and press **ENTER**.
- Press **ENTER** key once more to display the **REMOTE MONITOR** window. The lower display will show "w" and three 4 digit decimal numbers (**w 1111 2222 3333**).

The numbers represent the Cross Level, Level and Azimuth rate sensor outputs respectively each having a nominal display of 2048. The display values will change during movement and return to nominal when movement stops.

The Cross Level display should decrease when the antenna is tilted to the left and increase when tilted to the right.

The Level display should decrease when the antenna is tilted forward and increase when tilted back.

The Azimuth display should decrease when rotated CCW and increase when rotated CW.

7.3.6. Open Loop Motor Test

The ACU provides a means for driving each individual torque motor to test that motors functionality. By driving each axis and observing the resulting motion of the antenna, a coarse operational status of the motor and motor driver can be established.

- To manually drive the motors, select the **REMOTE COMMAND** window on the ACU:
- Using the **LEFT/RIGHT** and **UP/DOWN** arrow keys set the Remote Command value to "**^0000**" and press **ENTER**.
- To drive the Cross Level motor, key in ^1064, ^1128 or ^1192 and press **ENTER** to drive the Cross Level axis LEFT, OFF or RIGHT respectively.
- To drive the Level motor, key in ^2064, ^2128 or ^2192 and press **ENTER** to drive the level axis FORWARD, OFF or BACKWARD respectively.
- To drive the Azimuth motor, key in ^3064, ^3128 or ^3192 and press **ENTER** to drive the azimuth axis CW, OFF or CCW.

7.3.7. To Disable/Enable DishScan

For testing and calibration purposes you may need to temporarily disable DishScan (and thus the drive it produces).

To turn **DISHSCAN** drive off:

1. Using the ACU front panel, Select the Setup Remote Parameter "**DISHSCAN**":
2. Press the **RIGHT** arrow.
3. Press the **UP** arrow (verify status changes to "OFF").
4. Press the **ENTER** key.

If DishScan is **OFF** and the **Step Integral** parameter is set to **0000**, you will get a **constant** ACU ERROR **0016** (DishScan error) and you will see **zeros** flashing in the lower left of the Azimuth and Elevation ENTRY sub-menu displays. This is a visual indication that DishScan is turned OFF.

To turn **DISHSCAN** drive on:

1. Using the ACU front panel, Select the Setup Remote Parameter "**DISHSCAN**":
2. Press the **RIGHT** arrow.
3. Press the **UP** arrow (verify status changes to "ON").
4. Press the **ENTER** key.

DO NOT SAVE this parameter disabled to the Pedestal Control Units NVRAM unless doing so for a specific system test. DishScan drive and signaling is *required* for normal operation. A failure to operate with DishScan enabled will result in degraded system performance due to the direct inability to make proper tracking decisions.

7.3.8. Satellite Reference Mode

The ship's gyro compass input to the ACU may be accurate and stable in static conditions and yet may NOT be accurate or stable enough in some underway dynamic conditions. If the gyro compass input is corrupt, not stable the errors will become large enough to cause the antenna to be mis-pointed off satellite as the system compensates for what it assumes to be actual vessel movement.

Satellite Reference Mode will uncouple the gyro reference from the azimuth rate sensor control loop. This decoupling of the Gyro source only happens 2.5 minutes after an azimuth command has been sent to the antenna by means of an AZ target command, a search pattern initiated, or the a Satellite is retargeted. When operating in Satellite Reference Mode changes in ship's gyro reading will reflect its changes to the ACU's display but will not directly affect the azimuth control loop. The Pedestal Control Unit will stabilize the antenna based entirely on the azimuth rate sensor loop and the tracking information from DishScan. This will keep the azimuth rate sensor position from eventually drifting away at a rate faster than the tracking loop can correct by using the tracking errors to regulate the rate sensor bias.

Satellite Reference Mode can be used as a diagnostic mode to determine if tracking errors are caused by faulty gyro inputs.

Satellite Reference Mode enabled is the recommended mode of operation regardless of GYRO type.

To view, or change, the Satellite Reference Mode status, select the SAT REF remote parameter:

1. Press the RIGHT arrow, then press the UP arrow and last press the ENTER key to turn Satellite Reference Mode ON.
2. Press the RIGHT arrow, then press the DOWN arrow and last press the ENTER key to turn Satellite Reference Mode OFF.

If you change this remote parameter, you must save the change using REMOTE PARAMETERS.

7.3.9. To Read/Decode an ACU Error Code 0008 (Pedestal Error):

Using the DAC2202, Select the REMOTE COMMAND window on the ACU and;

1. Using the **LEFT/RIGHT** and **UP/DOWN** arrow keys set the Remote Command value to **"S0000"** (the S must be upper case) and press **ENTER**.
2. Press **ENTER** key once more to display the **REMOTE MONITOR** window. **SAB^C@** will be displayed (S followed by 3 letters and a symbol (checksum). The fourth letter (**C above**) is the pedestal error letter. Decode the letter code using the chart below:

Letter	REF	AZ	LV	CL	Description of Pedestal Error
@	0	0	0	0	None
A	0	0	0	1	CL
B	0	0	1	0	LV
C	0	0	1	1	CL + LV
D	0	1	0	0	AZ
E	0	1	0	1	AZ + CL
F	0	1	1	0	AZ + LV
G	0	1	1	1	AZ + LV + CL
H	1	0	0	0	Ref
I	1	0	0	1	Ref + CL
J	1	0	1	0	Ref + LV
K	1	0	1	1	Ref + LV + CL
L	1	1	0	0	Ref + AZ
M	1	1	0	1	Ref + AZ + CL
N	1	1	1	0	Ref + AZ + LV
O	1	1	1	1	Ref + AZ + LV + CL
P	0	0	0	0	Stab Limit
Q	0	0	0	1	Stab Limit + CL
R	0	0	1	0	Stab Limit + LV
S	0	0	1	1	Stab Limit + CL + LV
T	0	1	0	0	Stab Limit + AZ
U	0	1	0	1	Stab Limit + AZ + CL
V	0	1	1	0	Stab Limit + AZ + LV
W	0	1	1	1	Stab Limit + AZ + LV + CL
X	1	0	0	0	Stab Limit + Ref
Y	1	0	0	1	Stab Limit + Ref + CL
Z	1	0	1	0	Stab Limit + Ref + LV
[	1	0	1	1	Stab Limit + Ref + LV + CL
\	1	1	0	0	Stab Limit + Ref + AZ
]	1	1	0	1	Stab Limit + Ref + AZ + CL
^	1	1	1	0	Stab Limit + Ref + AZ + LV
_	1	1	1	1	Stab Limit + Ref + AZ + LV + CL

Stability Limit (Stab Limit)

Indicates that the above decks equipment is mis-pointed from its intended target by more than 0.5°. (FCC Tx Mute Compliance)

AZ Reference Error (Ref)

Indicates a failure to integrate one the reference inputs within the Azimuth Stabilization Loop. (i.e. encoder or Home Flag error)

AZ Servo Limit (AZ)

Indicates the current draw through the Azimuth Servo Amplifier (motor driver PCB) has exceeded what is required during normal operation (i.e. as the result of physical binding)

LV Servo Limit (LV)

Indicates the current draw through the Elevation Servo Amplifier (motor driver PCB) has exceeded what is required during normal operation (i.e. as the result of physical binding or antenna imbalance)

CL Servo Limit (CL)

Indicates the current draw through the Cross-Level Servo Amplifier (motor driver PCB) has exceeded what is required during normal operation (i.e. as the result of physical binding or antenna imbalance)

7.3.10. Get Remote GPS LAT/LON Position:

The remote command in the DAC-2200 to get the position from the GPS antenna mounted on the antenna pedestal is @0000.

To send this remote command to the PCU;

- Select the REMOTE COMMAND window on the ACU and;
- Press the LEFT arrow key to bring up the cursor and move it to the left until the current symbol in front of the 0000 is underscored.
- Increment or decrement the symbol using the UP & DOWN arrow keys until the @ character followed by four zeros is displayed.
- Press the ENTER key to send the command to the PCU.
- Press ENTER, or the DOWN arrow key, to access the REMOTE MONITOR. The GPS Latitude & Longitude position and status will be displayed on the bottom line of the display.

The Latitude & Longitude position of the GPS will be displayed in the following format:

@ LAT,N,LON,E,A & where LAT and LON are in degrees and minutes, LAT will be followed by N or S (North or South), LON will be followed by E or W (East or West), then a status character and finally a checksum character. Furuno default value is in Japan at 34.4N 135.2E (@3444,N,13521,E,,_). After acquiring a good fix at Sea Tel the string is @3800,N,12202,W,A^ for our 38N 122W Latitude and Longitude position.

The status character tells you the status of the GPS. Comma = GPS has NOT acquired a fix, N = GPS fix is NOT valid and A = GPS has acquired a valid fix.

As a test, if a valid fix is being viewed in the Remote Monitor window and the GPS antenna cable is unplugged from the PCU, the status character which was an A should become an N within 5 seconds.

7.3.11. Troubleshooting using DacRemP

While troubleshooting a Sea Tel 3-Axis Antenna System, you must classify the fault you are dealing with as a failure within one of 3 major system functions, Targeting, Stabilization, and Tracking. Should there be a failure with any one of these functions, your system will not operate properly. A few simple checks may help determine which fault (if any) that you are dealing with. The matrix below lists some test(s) and which of the DacRemP graph selection would be best to use to identify a fault. The end of this chapter contains examples on how to use DacRemP to diagnose a fault.

Targeting: is the ability to accurately point the antenna to an angular position in free space and is controlled by the ACU. (Does the system drive to the Azimuth, Elevation, and Polarity positions within 1 degree of the desired satellite?)

Stabilization: is the process of de-coupling the ships motion from the antenna and is controlled by the PCU. (Does the system maintain the satellite link after turning off TRACKING?)

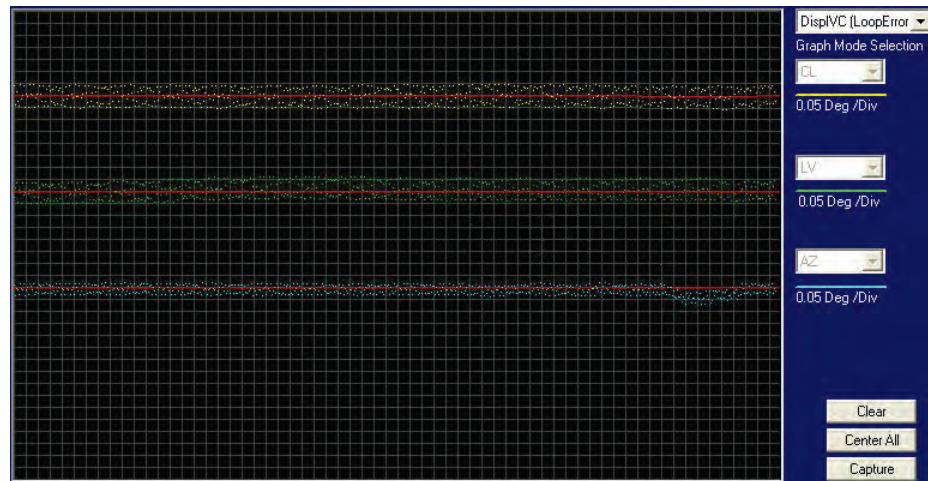
Tracking: is the process of issuing fine adjustments to the **pointing** angle of the antenna to optimize the received signal level and is controlled by the ACU. (Does the system pass a four quadrant-tracking test?)

Functional Test(s)	DacRemP Graph Selection to use	System Function(s)
Four Quadrant Tracking.	ADMC (Position)	Tracking
Azimuth Encoder Verification.	ADMC (Position)	Targeting
Sea Trial	ADMC (Position)	Targeting Tracking Stabilization
Side Lobe Plots	ADMC (Position)	Tracking
Targeting Alignment (AZ & EL Trims)	ADMC (Position)	Targeting
Determine Blockage Mapping	ADMC (Position)	Tracking
Unwrap recovery (Limited Az systems only)	ADMC (Position)	Stabilization
Pedestal Gain Verification	DISPIVC (Loop Error)	Stabilization
Home switch (flag) verification (Unlimited Az systems only)	DISPV (Ref)	Stabilization
Remote Tilt Verification	DISPV (Ref)	Targeting Stabilization
Level cage alignment Verification (sensor alignment)	DISPV (Ref)	Targeting Stabilization
Rate Sensor Output Verification	DISPW (Rate)	Stabilization
Level and CL fine balance Verification	DISPTC (Drive)	Stabilization
AZ Friction Torque Test	DISPTC (Drive)	Stabilization
DishScan Drive/Phase	DishScan XY	Tracking Stabilization

7.3.12. Antenna Loop Error Monitoring

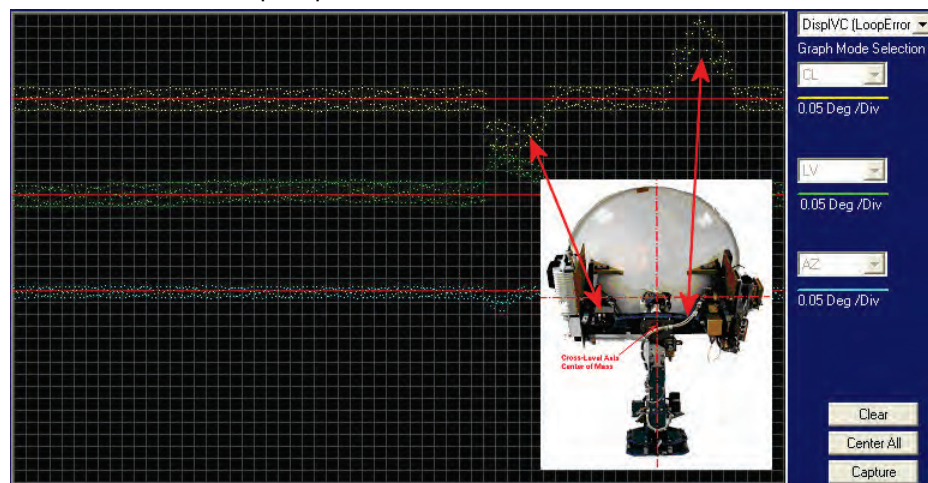
The DacRemP **DISPIVC** graph chart provides a means for monitoring the accumulated velocity errors of the antenna for diagnostic purposes. If this error is excessive, it indicates external forces are acting on the antenna. These forces may be the result of but not restricted to static imbalance, excessive bearing friction, cable binding, or wind loading. If these forces cause the antenna to mis-point by more than 0.5° from the desired position the PCU will flag a “Stab Limit” error.

To view the position error, select the **DisplVC (LoopError)** graph chart.



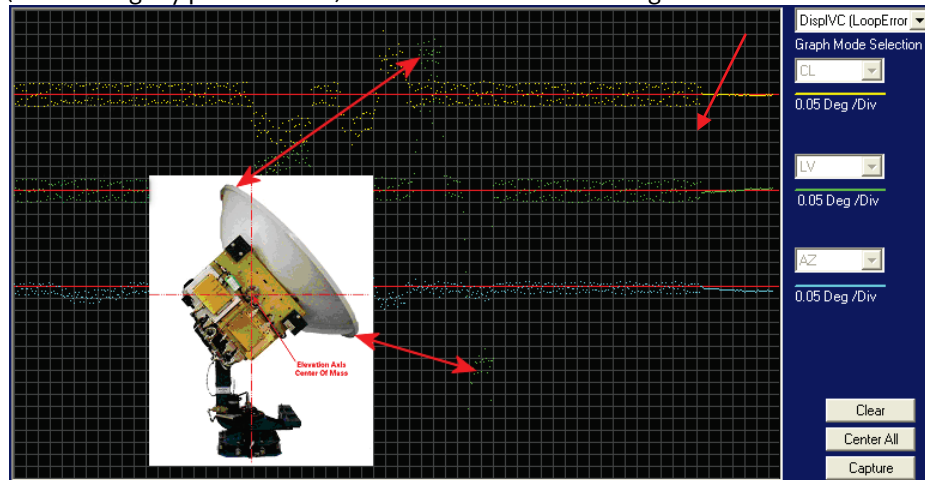
This chart displays sensed axis errors via three traces, CL (Cross Level), LV (Elevation), and AZ (Azimuth), at a fixed 0.05°/ vertical division.

The normal trace average will plot its display ± 3 divisions from the red reference line. Any trace line average plotted above this is of concern and troubleshooting required. The example below shows the forces exerted onto the antenna as a resultant of DishScan Drive. The example below shows the results of various forces put upon antenna.



Cross-Level Axis physically moved CCW (down to the left.) and then CW (up to the right.)

Elevation Axis physically moved CW. (reflector slightly pushed up) and then physically moved CCW. (reflector slightly pushed down.) At the end of chart recording shows



DishScan Drive turned Off, notice the lack of accumulated IVC errors.

7.3.13. Reference Sensor Monitoring

The DacRemP **DISPV** graph chart provides a means for monitoring the output of the 2 Axis Tilt Sensor and the Home Switch sensor for diagnostic purposes. The Tilt sensor (located inside the Level Cage Assembly) is the primary input for the antenna's reference to the horizon (0° Elevation and 90° Cross-Level). While the Home Switch Sensor (located at the antenna base) is used to calibrate the antenna's position relative to the vessels BOW.

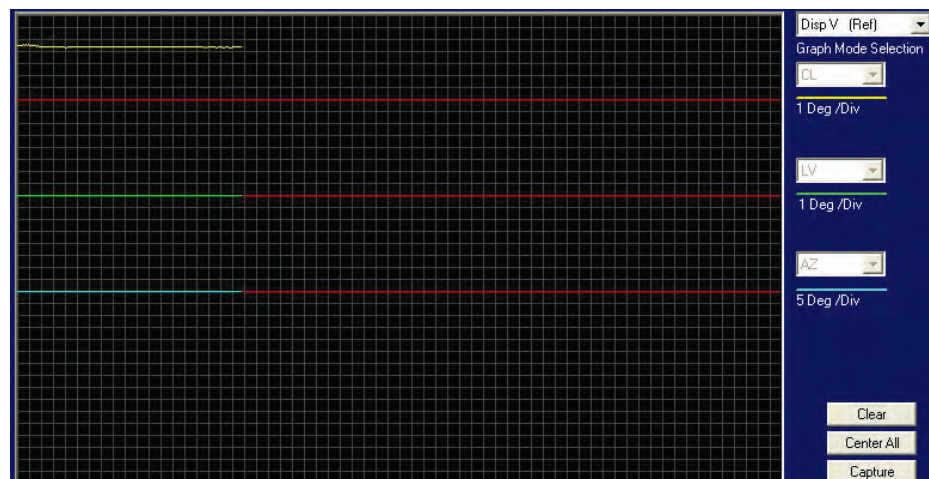
To view the reference sensors, select the **Disp V (Ref)** graph chart.

This chart displays the output of the Tilt Sensor via two traces, CL (Cross Level), LV (Elevation) at a fixed 1°/ vertical division, and the home flag logic level via a single trace, AZ (Azimuth).



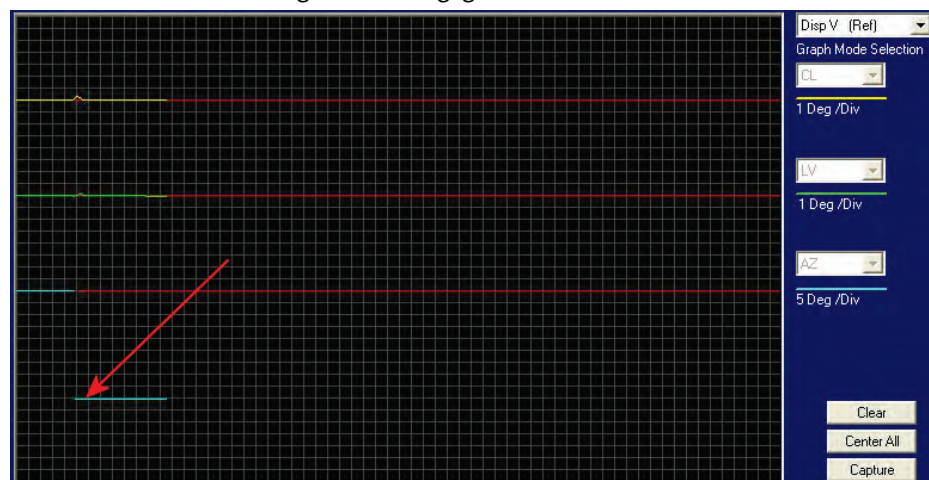
The normal trace display for the Tilt Sensor, after performing remote tilt calibration, will be ± 4 divisions from the red reference line. Any trace line average plotted above this is of concern and troubleshooting required. See below for a screen capture of an antenna that is Level in both the Cross-Level and Elevation Axis.

The Cross Level Tilt display should plot on the red reference line when the level cage is level, referenced to the horizon. It should decrease (plots below red line) when the antenna is tilted to the left and increase (plots above red line) when tilted to the right. See below for a screen capture of an abnormal CL trace Plot, it is an indication that the antenna that is either listed to the right approx. 4 degrees or the PCU requires to much CL tilt bias.



The Level tilt display should plot on the red reference line when the level cage is level, referenced to the horizon. It should decrease (plots below red line) when the antenna is tilted forward (EL down) and increase (plots above red line) when tilted back (EL up).

The Azimuth display for the Home Switch will normally display a logic level high (plots directly on Red reference line after clicking on the **Center All** button) when the home flag is NOT engaged and changing to a logic level low when engaged. See below for a screen capture of an antenna that was driven so that the Home Flag switch is engaged.



7.3.14. Open Loop Rate Sensor Monitoring

The DacRemP **DISPW** graph chart provides a means for monitoring the output of the 3 solid state rate sensors (located inside the Level Cage Assembly) for diagnostic purposes. The rate sensors are the primary inputs to the PCU for stabilization.

To monitor the rate sensors, select the **Disp'W' (Rate)** graph chart

This chart displays sensed output from the 3 rate sensors via three traces, CL (Cross Level), LV (Elevation), and AZ (Azimuth), at a fixed 1°/Second/vertical division.

A normal trace display will be ± 1 divisions from the red reference line. The example shown below shows an antenna that is NOT currently sensing motion in any axis.



The Cross Level display should decrease (plots below red line) as the antenna is tilted to the left and increase (plots above red line) as the antenna tilted to the right.

The Level display should decrease (plots below red line) as the antenna is tilted forward and increase (plots above red line) as the antenna is tilted back.

The Azimuth display should decrease (plots below red line) as the antenna is rotated CCW and increase (plots above red line) as the antenna is rotated CW. In the example below, the output of the Azimuth rate sensor is plotted above the reference line, indicating that the antenna was driven CW in Azimuth. Due to the in-practicality of driving an axis at a consistent rate, verification of rate sensor output is, for the most part restricted to a positive or negative response of the Level Cage movement (plotting above or below the red reference line of each axis).



7.3.15. Fine Balance and Monitoring Motor Drive Torque

The DacRemP **DISPTC** graph chart provides a means for monitoring torque commands required for each motor for diagnostic purposes and verifying antenna balance. By observing each trace, the required drive of the antenna via the motor driver PCB may be established.

To view the Torque Commands, select the **Disp TC (Drive)** graph chart.

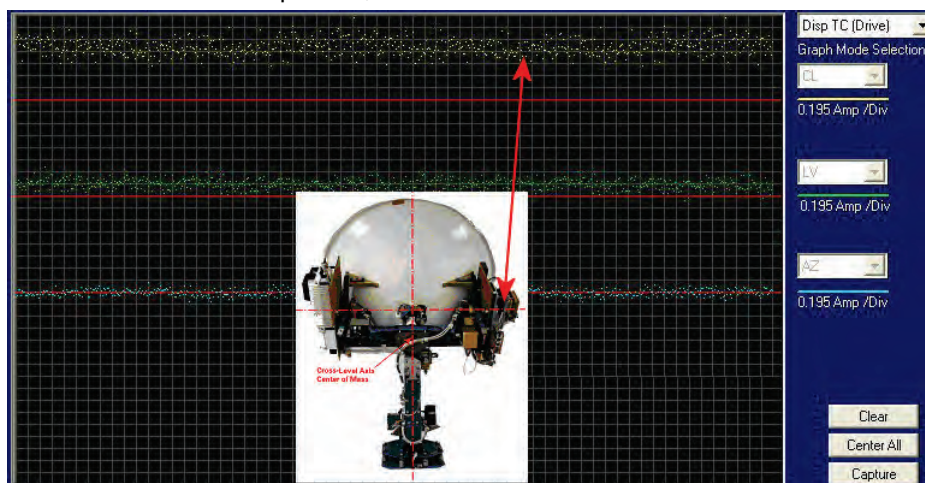
This chart displays the Torque Command errors for each axis via three traces, CL (Cross Level), LV (Elevation), and AZ (Azimuth), at a fixed 0.195amps/division.



A normal trace display will be ± 1 divisions from the red reference line while under calm sea conditions and with DishScan Drive turned off. See example below

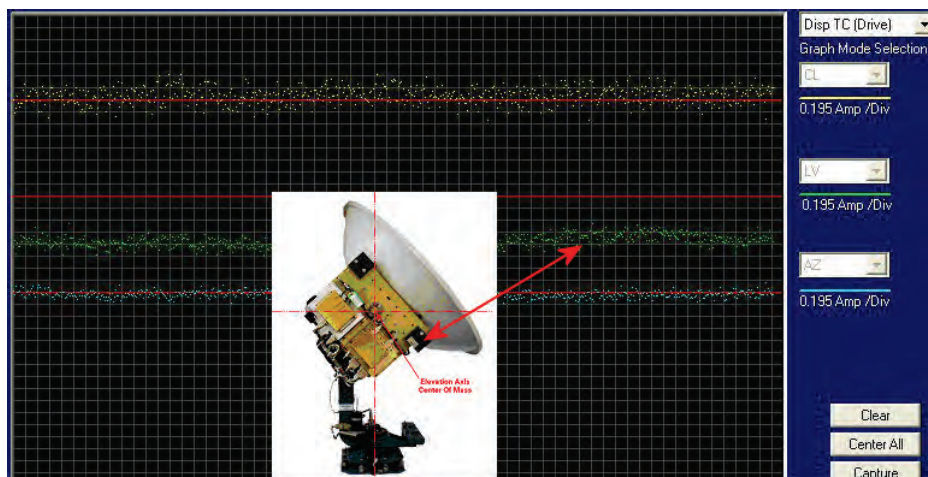
The Cross Level display will decrease (plots below red line) as the antenna requires drive to the left and increase (plots above red line) as the antenna requires to the right.

Example: The antenna pictured in the screen capture below is imbalanced so that it is “Right Heavy”. The CL trace is plotting above the red reference line (indicating that drive CCW is required to maintain a 90° Cross-Level position).



The Level display should decrease (plots below red line) as the antenna requires drive forward (Up in elevation) and increase (plots above red line) as the antenna requires drive back (Down in elevation).

Example: The antenna pictured in the screen capture below is imbalanced so that it is “Front Heavy”. The LV trace is plotting above the red line (indicating that drive CW is required to maintain the current elevation position).



The Azimuth display should decrease (plots below red line) as the antenna is driven CCW and increase (plots above red line) as the antenna is rotated CW.

7.3.16. Open Loop Motor Test

The DacRemP **Comm Diagnostics** Window provides a means to enter in Remote Commands for driving each individual torque motor to test that motors functionality. By driving each axis and observing the resulting motion of the antenna, a coarse operational status of the motor and motor driver may be established.

To manually drive the motors, select the “**Comm Diagnostics**” window under to the Tools submenu or Press “CTRL + C”

Using the small field in the upper left hand corner of the window, type in the remote command and verify the motor appropriately drives in the direction commanded.

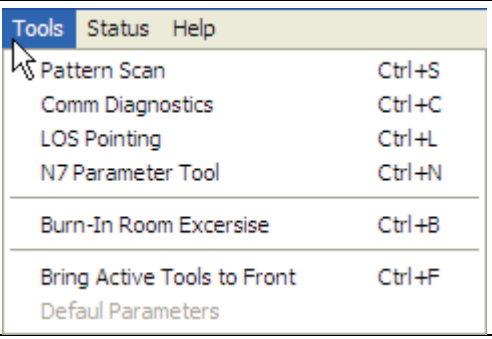
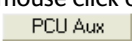
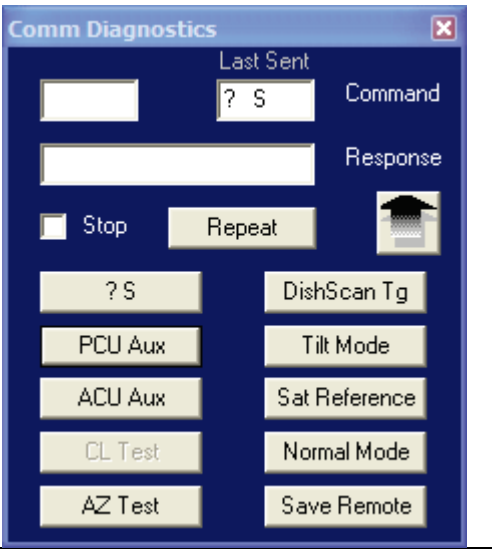
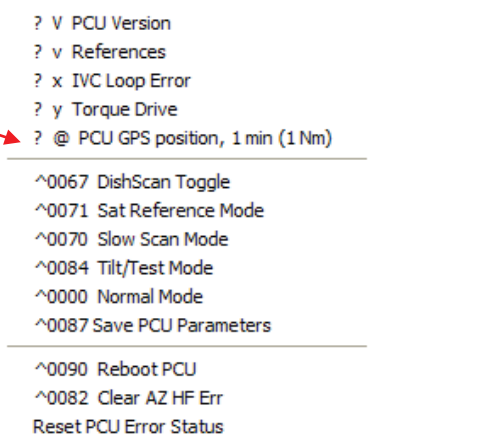
To drive the Cross Level motor, key in ^1064, ^1128 or ^1192 and press **ENTER** to drive the Cross Level axis LEFT, OFF or RIGHT respectively.

To drive the Level motor, key in ^2064, ^2128 or ^2192 and press **ENTER** to drive the level axis FORWARD, OFF or BACKWARD respectively.

To drive the Azimuth motor, key in ^3064, ^3128 or ^3192 and press **ENTER** to drive the azimuth axis CW, OFF or CCW.

7.3.17. Remote GPS LAT/LON Position:

The above decks equipment has an integrated on board Furuno GPS antenna system. The Latitude and Longitude position information provided are utilized to calculate the Azimuth, Elevation, Cross-level and Polarity pointing angles of the desired satellite. The DacRemP “**Comm Diagnostics**” Window provides a means to query the GPS antenna to verify proper operation. The procedure below describes this process.

Select the “Comm Diagnostics” window under to the Tools submenu or Press “CTRL + C”	 The screenshot shows a menu with the following items and shortcuts: - Pattern Scan (Ctrl+S) - Comm Diagnostics (Ctrl+C) - LOS Pointing (Ctrl+L) - N7 Parameter Tool (Ctrl+N) - Burn-In Room Exercise (Ctrl+B) - Bring Active Tools to Front (Ctrl+F) - Default Parameters
Left mouse click on the  icon.	 The screenshot shows the 'Comm Diagnostics' window with the following elements: - Last Sent: ? S - Command: ? S - Response: (empty field) - Buttons: Stop, Repeat, ? S, DishScan Tg, PCU Aux, Tilt Mode, ACU Aux, Sat Reference, CL Test, Normal Mode, AZ Test, Save Remote.
Left Mouse click on the “?@ PCU GPS position, 1 min (1 Nm)”	 The screenshot shows a list of commands with a red arrow pointing to the selected command: ? V PCU Version ? v References ? x IVC Loop Error ? y Torque Drive ? @ PCU GPS position, 1 min (1 Nm) ^0067 DishScan Toggle ^0071 Sat Reference Mode ^0070 Slow Scan Mode ^0084 Tilt/Test Mode ^0000 Normal Mode ^0087 Save PCU Parameters ^0090 Reboot PCU ^0082 Clear AZ HF Err - Reset PCU Error Status

In the "Response" window verify proper GPS position to within 1 nautical mile of your current position. The Latitude & Longitude position of the GPS will be displayed in the following format: "@ LAT,N,LON,E,A" Where LAT and LON are in degrees and minutes, LAT will be followed by N or S (North or South), LON will be followed by E or W (East or West), then a status character and finally a checksum character.	
Furuno default value is in Japan at 34.4N 135.2E (@3444,N,13521,E,,_). After acquiring a good fix at Sea Tel the string is @3800,N,12202,W,A` for our 38N 122W Latitude and Longitude position. The status character tells you the status of the GPS. “,” (Comma) = GPS has NOT acquired a proper fix, “N” = GPS fix is NOT valid “A” = GPS has acquired a valid fix.	

7.1. Maintenance

Below are some procedures for removing/replacing some of the major components on the antenna.

7.1.1. To Adjust Tilt:

Select the REMOTE TILT window on the ACU and;

Set a bubble (or bulls-eye) level on top of the Level Cage assembly. **NOTE:** If the level cage is not within 4 degrees of level fore/aft or left/right, replace the Level Cage assembly.

If the level cage is within 4 degrees in BOTH For/Aft and Left/Right, use the **UP/DOWN** arrow keys to adjust LV (fore/aft) until the level cage is level in this axis.

Use the **LEFT/RIGHT** arrow keys to adjust CL (left/right) until the level cage is level in this axis.

Once the level cage is level in both axes, wait for 30 seconds then press the **ENTER** key.

Press **ENTER** to step the menu to **REMOTE PARAMETERS**.

Press the **LEFT** arrow key and then press the **ENTER** key to save the settings in the PCU.

This saves the new tilt bias settings in the PCU. Reset or re-initialize the antenna to verify that the Level cage is properly level with the new settings.

7.1.2. Balancing the Antenna

The antenna and equipment frame is balanced at the factory however, after disassembly for shipping or maintenance, balance adjustment may be necessary. Balancing must be done with the power supply turned off. No belt removal is required to balance the antenna pedestal. Balancing is accomplished by adding or removing balance trim weights at strategic locations to keep the antenna from falling forward/back or side to side. The antenna system is not pendulous so 'balanced' is defined as the antenna remaining at rest when left in any position. The antenna should be balanced within one or two ounces at the typical trim weight location of 2 feet from the axis of rotation.

The recommend balancing order is Elevation Axis with the antenna pointed at the horizon (referred to as front to back balance). Elevation Axis with the antenna pointed at zenith (referred to as top to bottom balance). Then Cross Level axis at any elevation position (referred to as side to side balance). The balance about azimuth axis is accomplished by accurately positioning the cross level beam in the azimuth stabilization assembly. This adjustment is done at the factory using special alignment tools. Do NOT attempt to adjust the cross level beam position in the field without the proper test fixtures.

7.2. Pedestal Control Unit Configuration – DTV04

The PCU is designed to be used with a variety of antenna pedestal models. So, the PCU must be configured correctly for the model number of the antenna it is mounted on. The configuration information that is unique to each pedestal model is stored in a Non Volatile Random Access Memory (NVRAM) in the PCU enclosure. If the PCU is replaced or the NVRAM in the PCU should become corrupt, the PCU must be re-configured to operate with the pedestal it is installed on. The default configuration for the PCU is model **xx04**. *In this configuration the Level Cage will drive normally but the PCU will not drive any of the three torque motors to prevent damage to the unknown pedestal.*

7.2.1. To configure the PCU:

Select the REMOTE COMMAND window on the ACU.

1. Using the **LEFT/RIGHT** and **UP/DOWN** arrow keys set the Remote Command value to "**N0004**" and press **ENTER**. The display should now show "N0004".
2. Press **ENTER** several times to select **REMOTE PARAMETERS**. Press **LEFT** arrow and then **ENTER** to save the system type in the PCU.
3. Press **RESET** and the displayed Remote Version Number should now display "**DTV04 VER N.nn**".

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8. Specifications

The specifications of your DTV04 HD antenna system are below.

8.1. Installed Weight

General Assembly:	100 lbs. (45.4 kg)
Radome Assembly (dry*):	75 lbs. (34.0 kg)
Total Weight (dry):	175 lbs. (79.4 kg)

8.2. Antenna Reflector/Feed Assembly

Type:	DIRECTV Slimline® Multi-Sat
Diameter:	32.5 inches
Antenna Gain @ 12 GHz	xx dB typical
Minimum EIRP	xxdB
Type	Hydro-formed Aluminum reflector
Feed	Slimline® AU9 Ku/Ka-band 5 LNB (4 stacked outputs)
Polarization	Circular
Reflector Skew (Tilt)	Remotely skewed adjustment using 24 volt DC motor, with potentiometer feedback.

8.3. Radome Assembly

Diameter:	51.75 inches (131.3 cm))
Height:	59 inches (149.9 cm) MAX
Type/Material:	Rigid fiberglass dome
Wind:	Withstand relative average winds up to 100 MPH from any direction.
Radome RF attenuation (dry *):	1.5 dB at 12 GHz

8.4. Stabilized Pedestal Assembly

Stabilization:	Three axis: Azimuth, Cross-level, and Level
Positioning:	Three Axis: Azimuth, Elevation, and Reflector Skew
AZ Drive motor:	Double stacked size 23 Brushless DC Motor w/Encoder
EL/CL Drive motors:	Size 23 Brushless DC Motors
Angular motion range:	
Elevation:	-15 to +110 degrees
Azimuth:	+/- 360 degrees (0 to 359.9)
Cross-Level:	Up to +/- 30 degrees
Stabilization Accuracy	0.2 degree PEAK error under maximum ship's motion condition
Elevation Pointing	00.0 (horizon) to 90.0 (zenith)
Relative Azimuth Pointing:	018.0 to 700.0
Specified Ship Motions (for stabilization accuracy tests):	
Roll:	+/- 15 degrees at 8-12 sec periods
Pitch:	+/- 10 degrees at 6-12 sec periods
Yaw:	+/- 8 degrees at 15 to 20 sec periods
Turning rate:	Up to 12 deg/sec and 15 deg/sec/sec
Headway:	Up to 50 knots
Mounting height:	Up to 150 feet.
Heave	0.5G
Surge	0.2G
Sway	0.2G
Maximum ship motion:	
Roll:	+/- 25 degrees w/6 sec periods
Pitch:	+/- 15 degrees w/6 sec periods
Yaw:	+/- 8 degrees w/6 sec periods
Tangential Acceleration:	+/- 0.5 g
Surge/Sway/Heave:	+/- 0.2 g
Turning rate:	12 deg/sec @ 5 deg/sec/sec
Headway:	Up to 30 knots

8.5. Pedestal Control Unit (PCU) Assembly

The PCU Assembly contains 2 Printed Circuit Boards (PCBs). One is the main control board and the other is the Motor Driver for the 3 Brushless DC Drive motors (AZ/EL/CL).

Connectors

Antenna Pedestal	44 Pin D-Sub connector
Motor Interface	25 Pin D-Sub connector
M&C Interface	15 Pin D-Sub connector
GPS Input	BNC connector

Controls

None

M&C Interface

9600 Baud RS-422

8.6. Environmental Conditions

Temperature:	-30 degrees C to 55 degrees C.
Humidity:	Up to 100% @ 40 degrees C, Non-condensing.
Spray:	Resistant to water penetration sprayed from any direction.
Icing:	Survive ice loads of 4.5 pounds per square foot. Degraded RF performance will occur under icing conditions.
Rain:	Up to 4 inches per hour. Degraded RF performance may occur when the radome surface is wet.
Wind:	Withstand relative average winds up to 100 MPH from any direction.
Vibration:	Withstand externally imposed vibrations in all 3 axes, having displacement amplitudes as follows:
Frequency Range, Hz	Peak Single Amplitude
4 - 10	0.100 inches (0.1G to 1.0G)
10 - 15	0.030 inches (0.3G to 0.7G)
15 - 25	0.016 inches (0.4G to 1.0G)
25 - 33	0.009 inches (0.6G to 1.0G)
Corrosion	Parts are corrosion resistant or are treated to endure effects of salt air and salt spray. The equipment is specifically designed and manufactured for marine use.

8.7. Control and IF Coax Cables**8.7.1. Antenna L-Band TVRO IF Coax Cables (Customer Furnished)**

5 Coax cables are required for your antenna system. It is also recommended that a 6th cable be installed as a spare. Due to the dB losses across the length of the RF coaxes at L-Band, Sea Tel recommends the following 75 ohm coax cable types (and their equivalent conductor size) for our standard pedestal installations:

Run Length	Coax Type	Conductor Size
up to 75 ft	RG-6 or LMR-300-75	18 AWG
up to 150 ft	RG-11 or LMR-400-75	14 AWG
up to 200 ft	LDF4-75 Heliax	10 AWG
Up to 300 ft	LMR-600-75	6 AWG

8.7.2. Multi-conductor Cables (Customer Furnished)

Due to the voltage losses across the multi-conductor cables, Sea Tel recommends the following wire gauge for the AC & DC multi-conductor cables used in our standard pedestal installations:

Run Length	Conductor Size
up to 50 ft	20 AWG (0.8 mm)
up to 100 ft	18 AWG (1.0 mm)
up to 150 ft	16 AWG (1.3 mm)
up to 250 ft	14 AWG (1.6 mm)
Up to 350 ft	12 AWG (2.0 mm)

Gyro Compass Interface Cable (Customer Furnished)

Type:	Multi-conductor, Shielded
Number of wires	4 Conductors for Step-By-Step Gyro, 5 for Synchro
Wire Gauge:	see Multi-conductor Cables spec above
Insulation:	600 VAC

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9. Drawings

This section contains all the drawings that apply to your Sea Tel Model DTV04 HD Antenna. Spare parts kits are included as a quick reference to the most common part numbers you might need. The drawings are organized into two groups:

9.1. Model DTV04 HD Specific Drawings

Drawing	Title	
121987_D	System Block Diagram	9-3
129471-1_A	General Assembly, DIRECT TV, 5LNB	9-6
129472-1_A	Antenna Assembly, DIRECT TV, 5LNB	9-8
122970-1_F1	Radome Assembly, 48" w/lip	9-10
122663_B4	Radome Installation Arrangement	9-13

9.2. Model DTV04 HD General Drawings

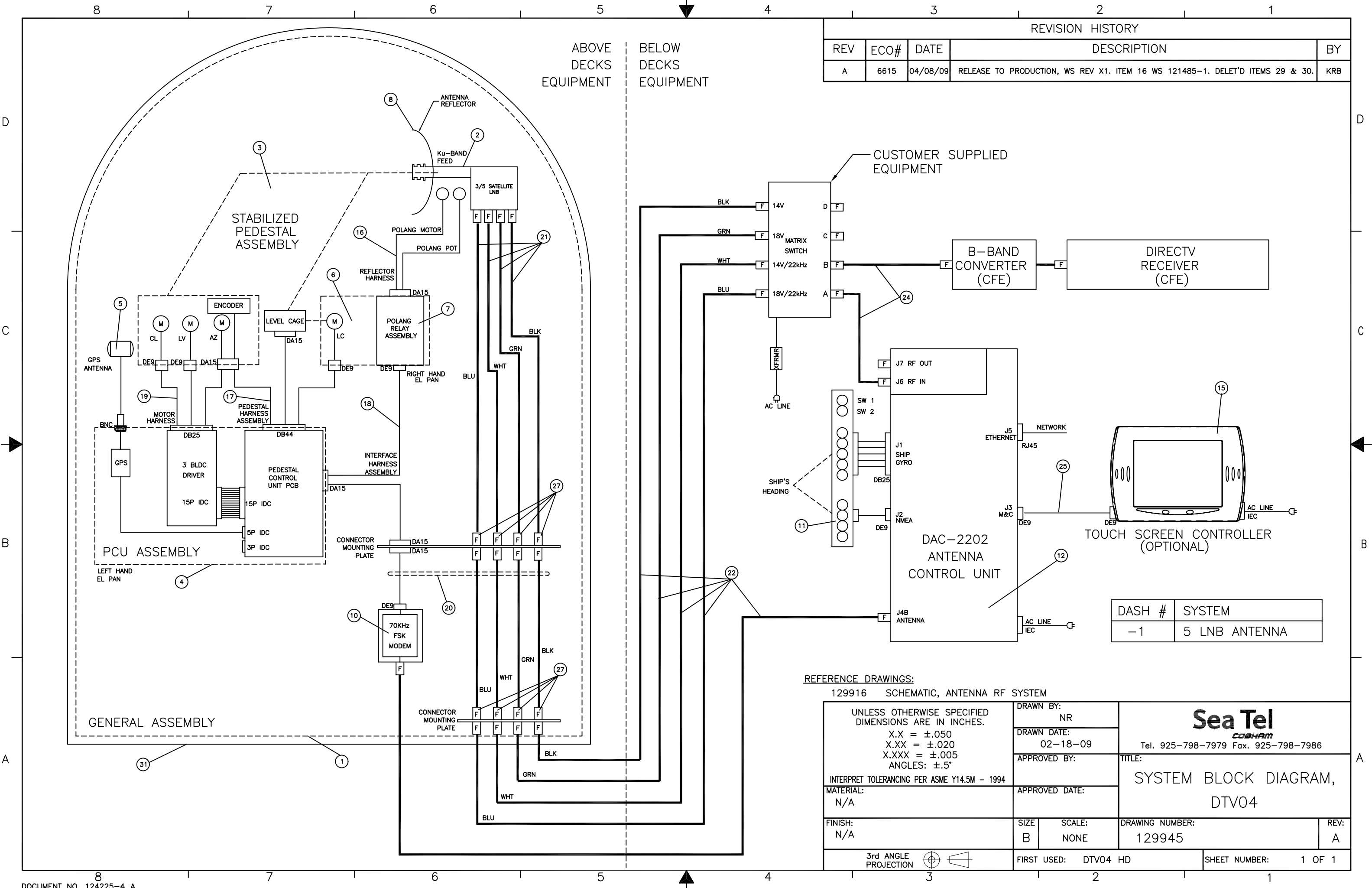
Drawing	Title	
121986_B1	Schematic, Antenna RF System xx04	9-14
122373_B2	Antenna Pedestal Schematic	9-15

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SINGLE LEVEL MFG BILL OF MATERIAL

FIND	QTY	PART NO	REV	DESCRIPTION	REFERENCE DESIGNATOR
1	1 EA	129471-1	A	GENERAL ASS'Y, DTV04 HD	
2	1 EA	129413	A	POLANG ASS'Y, DTV04 HD	
3	1 EA	129131-1	A1	PEDESTAL ASS'Y, 3004	
4	1 EA	122203-3	F1	PCU ENCLOSURE ASS'Y, DTV04 HD	
5	1 EA	121966-2	D1	GPS ANTENNA, RETERMINATED, 21.0 L	
6	1 EA	122937-1	J	LEVEL CAGE ASS'Y, BOTTOM EXIT, 080 P,	
7	1 EA	122202	A4	POLANG RELAY ASS'Y	
8	1 EA	128762-1	A	ANTENNA, DTV04 HD, 5 LNB	
10	1 EA	122363-1	E	MODEM ASS'Y, 70 KHz, ADE	
11	1 EA	116676	B2	TERMINAL MOUNTING STRIP ASS'Y, ACU	
12	1 EA	125411-1	H	DAC-2202, DVB RCVR, COAX IF	
15	1 EA	129500	A1	TOUCH SCREEN ASS'Y, TSC-10A	
16	1 EA	121485-1	F	HARNESS ASS'Y, REFLECTOR	
17	1 EA	122223-5	E3	HARNESS ASS'Y, PEDESTAL, REFERENCE	
18	1 EA	122224-2	A1	HARNESS ASS'Y, INTERFACE, DBS04	
19	1 EA	122225-2	F1	HARNESS ASS'Y, PEDESTAL, 3BLDC, DBS04	
20	1 EA	122370	C2	HARNESS ASS'Y, BASE SPINDLE, DBS04	
21	4 EA	122372		CABLE ASS'Y, RG-179, COLOR CODED, (RE	SEE DASH #.
22	5 EA	113480		CABLE ASS'Y, RF, RG6/RG11/CDF40, (REF	SEE DASH #.
24	2 EA	111115-6	B	CABLE ASS'Y, F(M)-F(M), 6 FT.	
25	1 EA	120643-10	A1	CABLE ASS'Y, RS232, 9-WIRE, STRAIGHT,	
27	8 EA	114178	O	ADAPTER, F(F)-F(F) (BULLET), 1.10 IN	
31	1 EA	125594-1	B	RADOME ASS'Y ,XX04 GA INSTALL, 50 IN,	

				
SYSTEM BLOCK DIAGRAM, DTV04 HD				
PROD FAMILY LIT	EFF. DATE 4/23/2009	SHT 1 OF 2	DRAWING NUMBER 129945-1	REV A



REVISION HISTORY				
REV	ECO#	DATE	DESCRIPTION	BY
A	6615	04/08/09	RELEASE TO PRODUCTION, WS REV X1. ITEM 16 WS 121485-1. DELET'D ITEMS 29 & 30.	KRB

REFERENCE DRAWINGS:
129916 SCHEMATIC, ANTENNA RF SYSTEM

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. X.X = ±.050 X.XX = ±.020 X.XXX = ±.005 ANGLES: ±.5° INTERPRET TOLERANCING PER ASME Y14.5M - 1994	DRAWN BY: NR		Sea Tel COBHAM Tel. 925-798-7979 Fax. 925-798-7986	
	DRAWN DATE: 02-18-09			
	APPROVED BY:		TITLE: SYSTEM BLOCK DIAGRAM, DTV04	
	APPROVED DATE:			
MATERIAL: N/A	SIZE B	SCALE: NONE	DRAWING NUMBER: 129945	REV: A
FINISH: N/A	FIRST USED: DTV04 HD		SHEET NUMBER:	1 OF 1

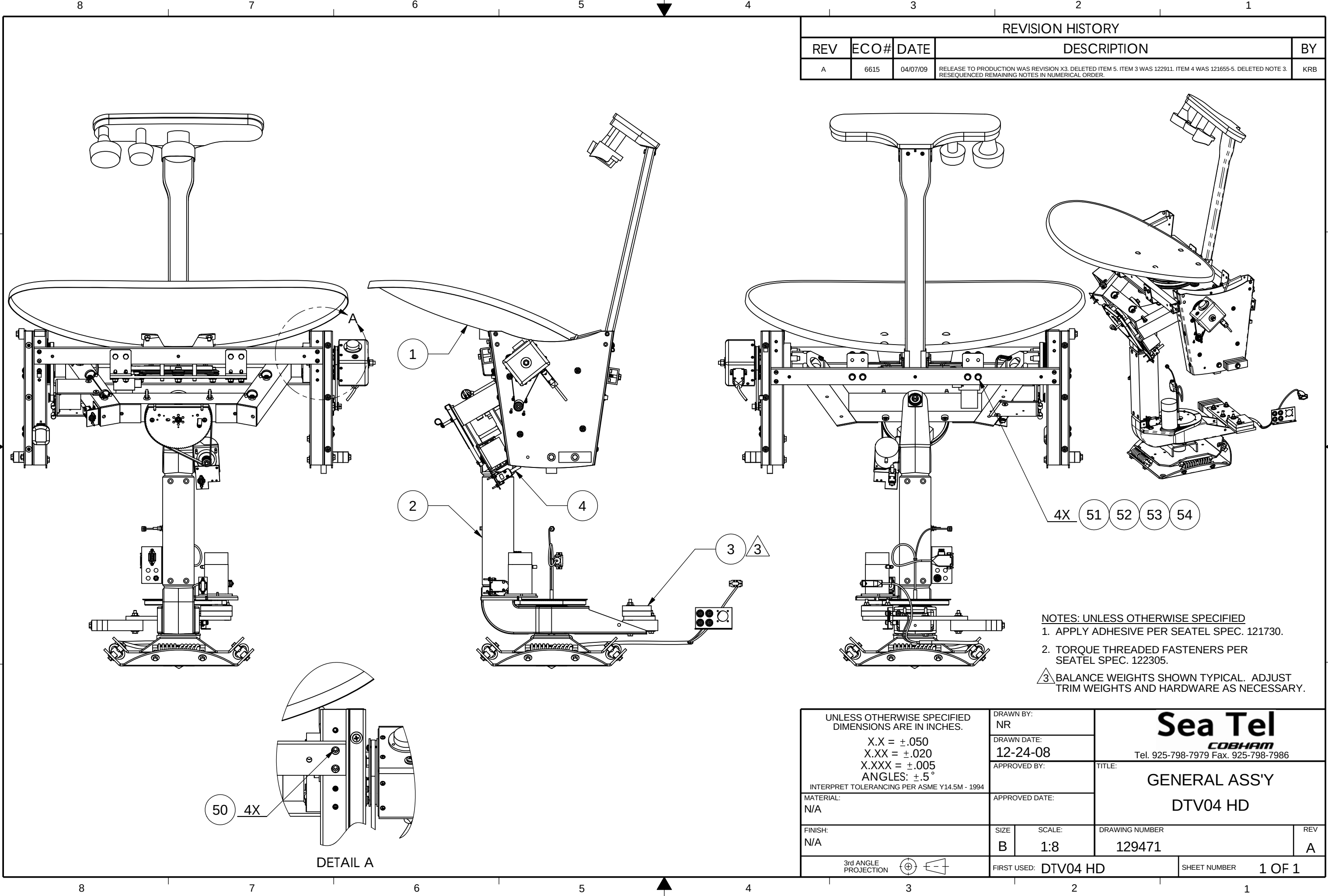
SINGLE LEVEL MFG BILL OF MATERIAL

FIND	QTY	PART NO	REV	DESCRIPTION	REFERENCE DESIGNATOR
1	1 EA	129472-1	A	ANTENNA ASS'Y, 5 LNB, DTV04 HD	
2	1 EA	129131-4	A1	PEDESTAL ASS'Y, 3004, DTV04 HD	
3	1 EA	130160-1	A	BALANCE WEIGHT KIT, DTV04 HD	
4	1 EA	121655-5	D	LABELS, INSTALLATION, DTV04 HD	
50	4 EA	114593-162		SCREW, SOCKET HD, 10-32 x 3/8, S.S.	
51	4 EA	114586-541		SCREW, HEX HD, 1/4-20 x 1-1/2, S.S.	
52	4 EA	119952-029	A1	WASHER, STAR, INTERNAL TOOTH, 1/4 IN,	
53	4 EA	114580-029		WASHER, FLAT, 1/4, S.S.	
54	4 EA	114583-029		NUT, HEX, 1/4-20, S.S.	

Sea Tel
COBHAM

GENERAL ASS'Y, DTV04 HD

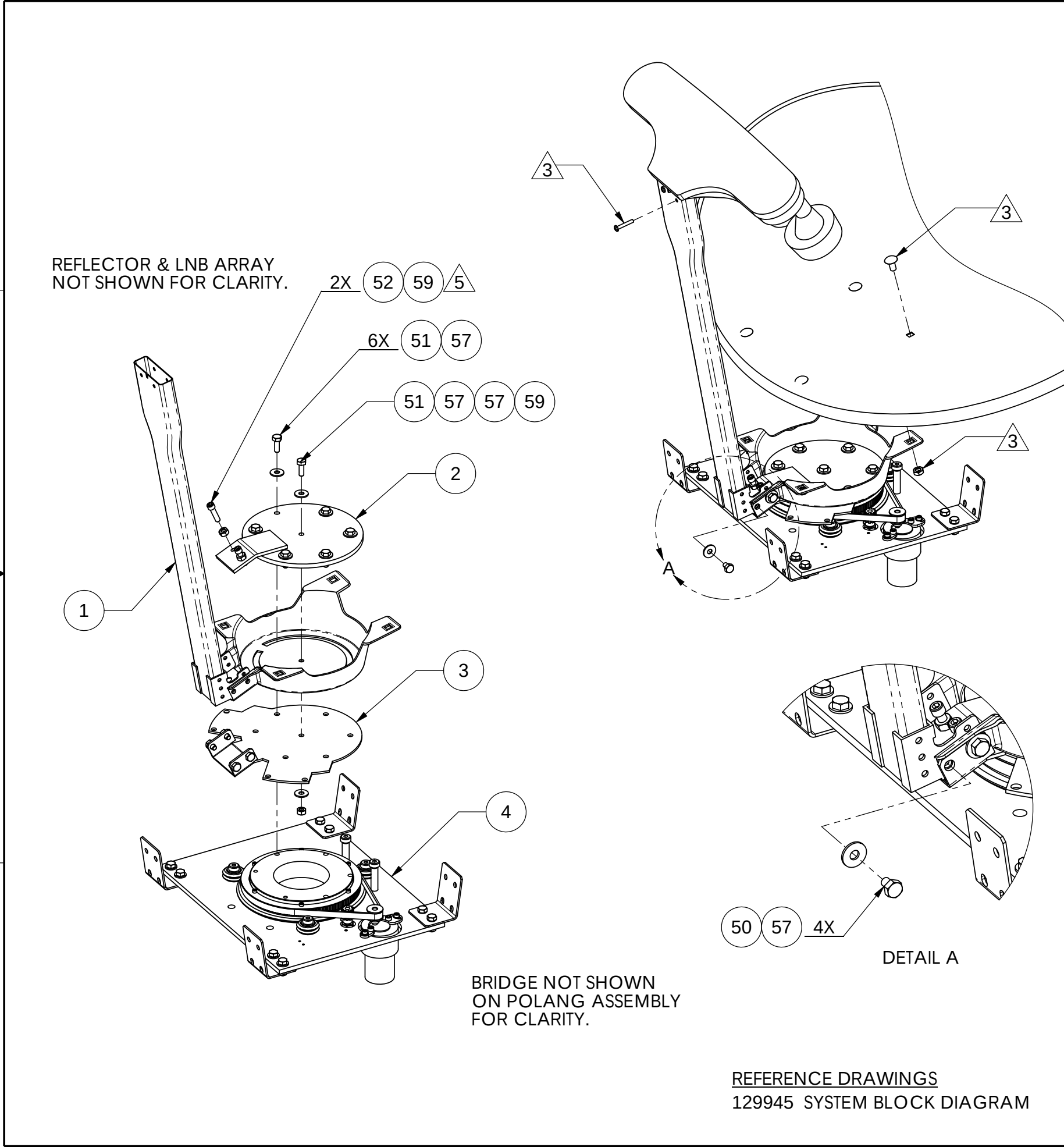
PROD FAMILY SERIES 04	EFF. DATE 4/23/2009	SHT 1 OF 1	DRAWING NUMBER 129471-1	REV A
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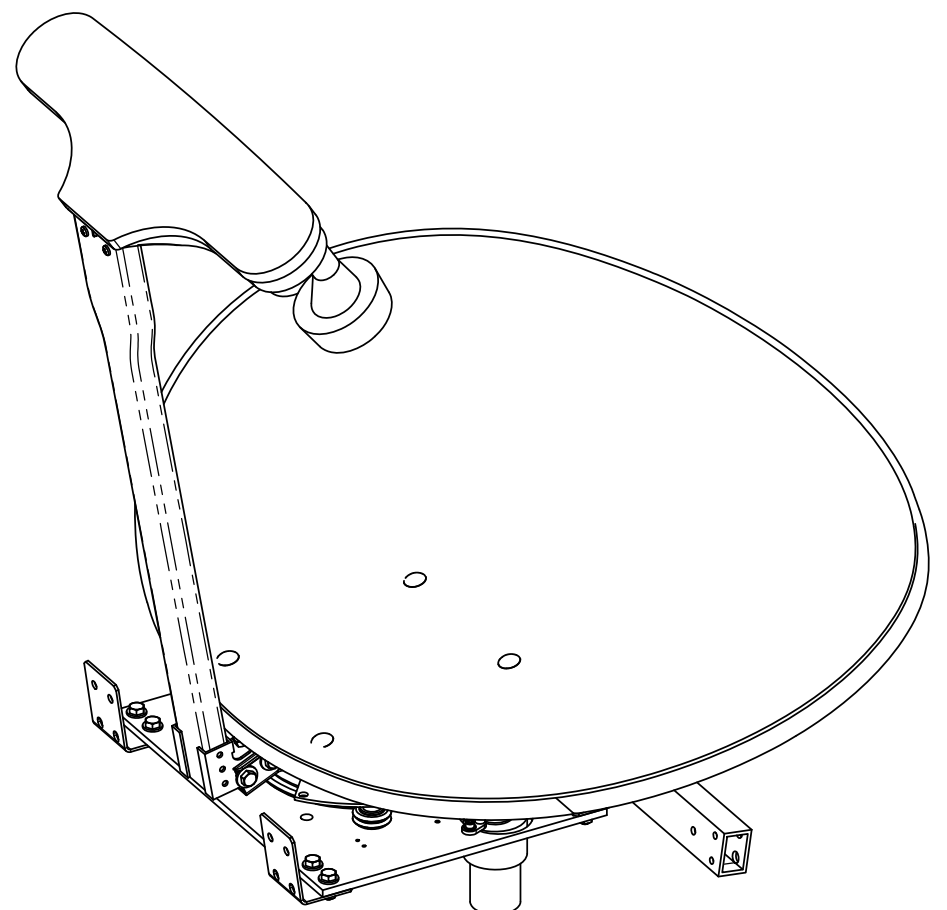
SINGLE LEVEL MFG BILL OF MATERIAL

FIND	QTY	PART NO	REV	DESCRIPTION	REFERENCE DESIGNATOR
1	1 EA	128762-1	A	ANTENNA, DTV04 HD, 5 LNB	
2	1 EA	129402	A	UPPER STIFFENER, DTV04 HD	
3	1 EA	129401	B	LOWER STIFFENER PLATE, DTV04 HD	
4	1 EA	129413	A	POLANG ASS'Y, DTV04 HD	
50	4 EA	114586-534		SCREW, HEX HD, 1/4-20 x 3/8, S.S.	
51	7 EA	114586-537		SCREW, HEX HD, 1/4-20 x 3/4, S.S.	
52	2 EA	114593-209		SCREW, SOCKET HD, 1/4-20 x 1, S.S.	
57	12 EA	114580-029		WASHER, FLAT, 1/4, S.S.	
59	3 EA	114583-029		NUT, HEX, 1/4-20, S.S.	

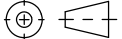
				
ANTENNA ASS'Y, 5 LNB, DTV04 HD				
PROD FAMILY COMMON	EFF. DATE 4/23/2009	SHT 1 OF 1	DRAWING NUMBER 129472-1	REV A



REVISION HISTORY				
REV	ECO#	DATE	DESCRIPTION	BY
A	6615	04/07/09	RELEASE TO PRODUCTION WAS REV. X4. ITEM 1 WAS 129398. ITEM 2 WAS 129402. ITEM 3 WAS 129401.DELETED ITEMS 5 THRU 10. MISC. HARDWARE CHANGES.	KRB



- NOTES: UNLESS OTHERWISE SPECIFIED
- 1. APPLY ADHESIVE PER SEATEL SPEC. 121730.
 - 2. TORQUE THREADED FASTENERS PER SEATEL SPEC. 122305.
 - 3 INDICATED HARDWARE IS INCLUDED WITH ITEM #1.
 - 4. BALANCE ANTENNA (ITEMS 1 THRU 3 & ASSOCIATED HARDWARE) USING PROCEDURE 130052 BEFORE MOUNTING TO ITEM 4.
 - 5 ADJUST ITEMS 52 & 59 TO REMOVE PLAY BETWEEN ITEMS 1 & 2.

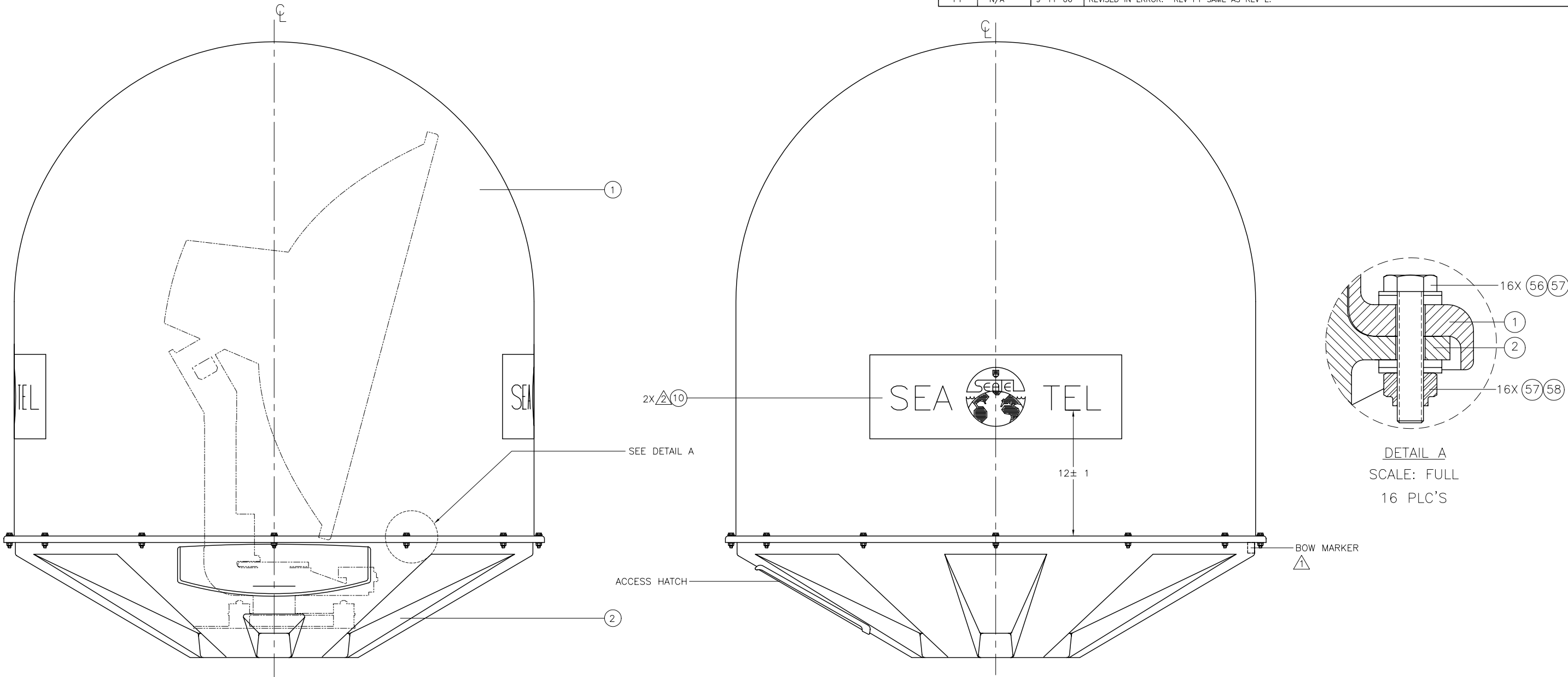
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. X.X = ±.050 X.XX = ±.020 X.XXX = ±.005 ANGLES: ±.5° INTERPRET TOLERANCING PER ASME Y14.5M - 1994	DRAWN BY: NR		Sea Tel COBHAM Tel. 925-798-7979 Fax. 925-798-7986	
	DRAWN DATE: 11-26-08			
	APPROVED BY:		TITLE: ANTENNA ASS'Y,5 LNB DTV04 HD	
	APPROVED DATE:			
MATERIAL: N/A	SIZE	SCALE:	DRAWING NUMBER	REV
FINISH: N/A	B	NONE	129472	A
3rd ANGLE PROJECTION 	FIRST USED: DTV04 HD		SHEET NUMBER	1 OF 1

SINGLE LEVEL MFG BILL OF MATERIAL

FIND	QTY	PART NO	REV	DESCRIPTION	REFERENCE DESIGNATOR
1	1 EA	122351-2	C1	RADOME TOP, 48 IN, W/ LIP, FOAM, WHIT	
2	1 EA	122784	C	RADOME BASE FAB ASS'Y, 48 IN, W/ LIP,	
3	3 EA	124903-1	B1	STRAIN RELIEF ASS'Y	
4	1 EA	118576	C	MOUNTING KIT, PEDESTAL	
5	10 EA	119801-012	B	CABLE TIE, NYLON, 4 IN, NATURAL	
6	1 EA	111679-7	O	CABLE CLAMP, NYLON, .50 DIA, #8 MTG H	
7	4 EA	114178	O	ADAPTER, F(F)-F(F) (BULLET), 1.10 IN	
8	.1 OZ	116702		ADHESIVE/SEALANT, E6000	
10	2 EA	110481-3	G	DECAL, LOGO, SEA TEL, 25.8 X 10 IN	
11	1 EA	109783-2		WRENCH, L	
14	1 EA	123549	F	KIT, RADOME HARDWARE MOUNTING	
50	2 EA	114588-148		SCREW, PAN HD, PHIL, 6-32 x 1/2, S.S.	
51	12 EA	114580-007		WASHER, FLAT, #6, S.S.	
52	6 EA	114583-007		NUT, HEX, 6-32, S.S.	
53	1 EA	114588-196		SCREW, PAN HD, PHIL, 8-32 x 5/8, S.S.	
54	2 EA	114580-009		WASHER, FLAT, #8, S.S.	
55	1 EA	114583-009		NUT, HEX, 8-32, S.S.	
56	12 EA	114586-540		SCREW, HEX HD, 1/4-20 x 1-1/4, S.S.	
57	24 EA	123665-416		WASHER, BONDED SEALING, 1/4, .275 IDX	
58	12 EA	119906-029		NUT, NYLON INSERT, 1/4-20	
60	4 EA	114588-150		SCREW, PAN HD, PHIL, 6-32 x 5/8, S.S.	
61	4 EA	121226-3012		SPACER, #6 X .25 OD X .125, ALUM, ALO	

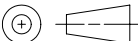
				
RADOME ASS'Y, XX04 GA INSTALL, 48 IN, WHITE/FOAM				
PROD FAMILY COMMON	EFF. DATE 4/23/2009	SHT 1 OF 2	DRAWING NUMBER 122970-1	REV F1

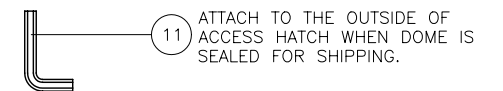
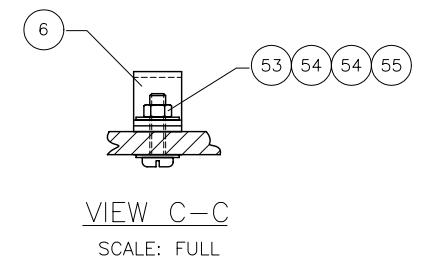
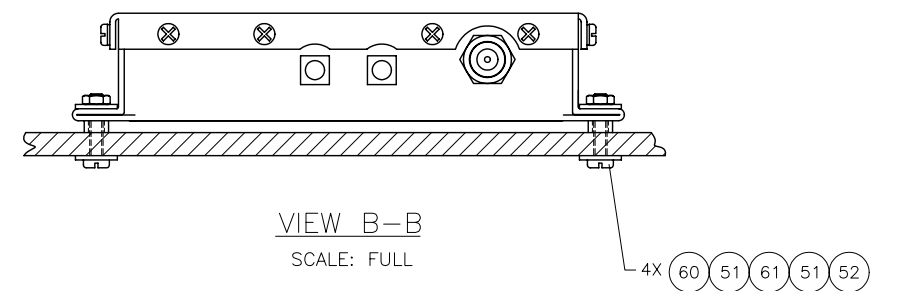
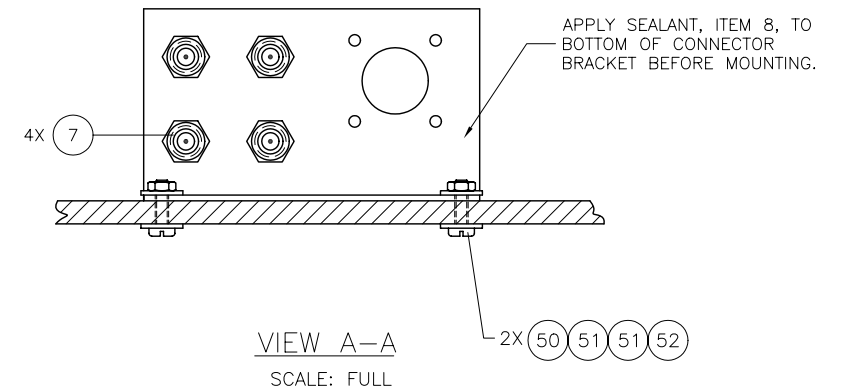
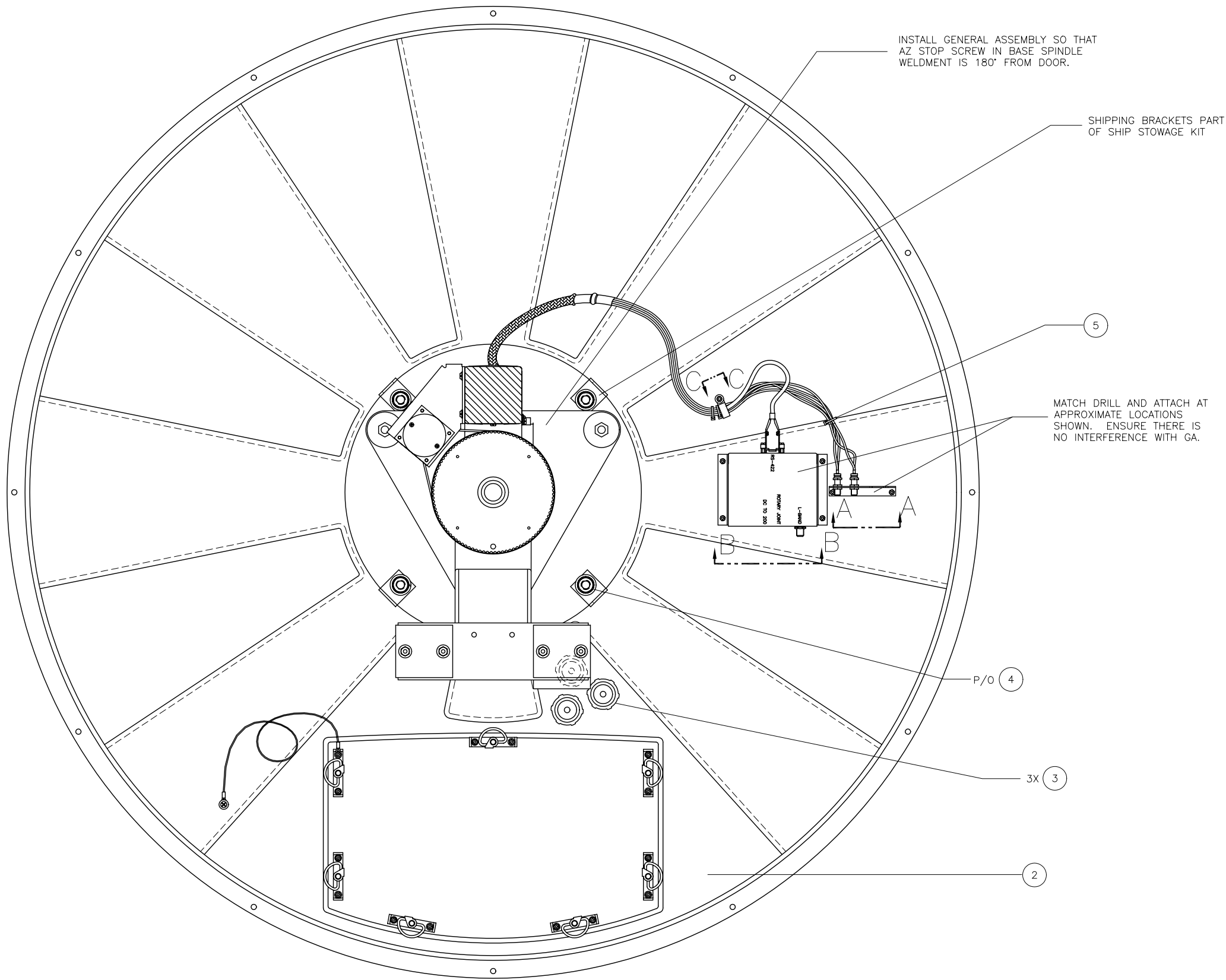
REV.	ECO#	DATE	DESCRIPTION	BY
X1	NA	5-3-04	NEW DRAWING	SCC
A	4521	7-13-04	REMOVED ITEM 9 P/N 122465. RELEASED TO PRODUCTION.	V.S.
B	4594	09-10-04	DEL ITEMS 13, 59. ITEM 4:118576 WS 118569. ITEM 56: QTY 12 WS 8. ADD ITEM 14. DEL DETAIL B.	SCC
"	"	"	LOCALIZE NOTES ON SHT 2. ADD GLOBAL NOTES 3, 4 TO SHT 1.	"
C	4651	11-11-04	DEL ITEM 12. ITEM 50:QTY 2 WS 6. ITEM 56 WS 114586-537; ITEM 57:123665-416 WS 114580-029. ADD ITEMS 60, 61.	SCC
C1	N/A	12-2-04	ADDED DASH 3	LK
D	4716	01-24-05	REPLACE ACORN NUTS WITH NYLOCS. ITEM 56 WS 114586-538; ITEM 58 WS 120731-360.	SCC
E	5050	11-14-05	ITEM 3 WAS P/N 109258-8.	V.S.
F	5236	8-17-06	IN TITLE, RADOME WS 48 INCH. ITEM 1 WS 122351-2, ITEM 2 WS 122784 DASH 1 ONLY.	SL
F1	N/A	9-11-06	REVISED IN ERROR. REV F1 SAME AS REV E.	SL



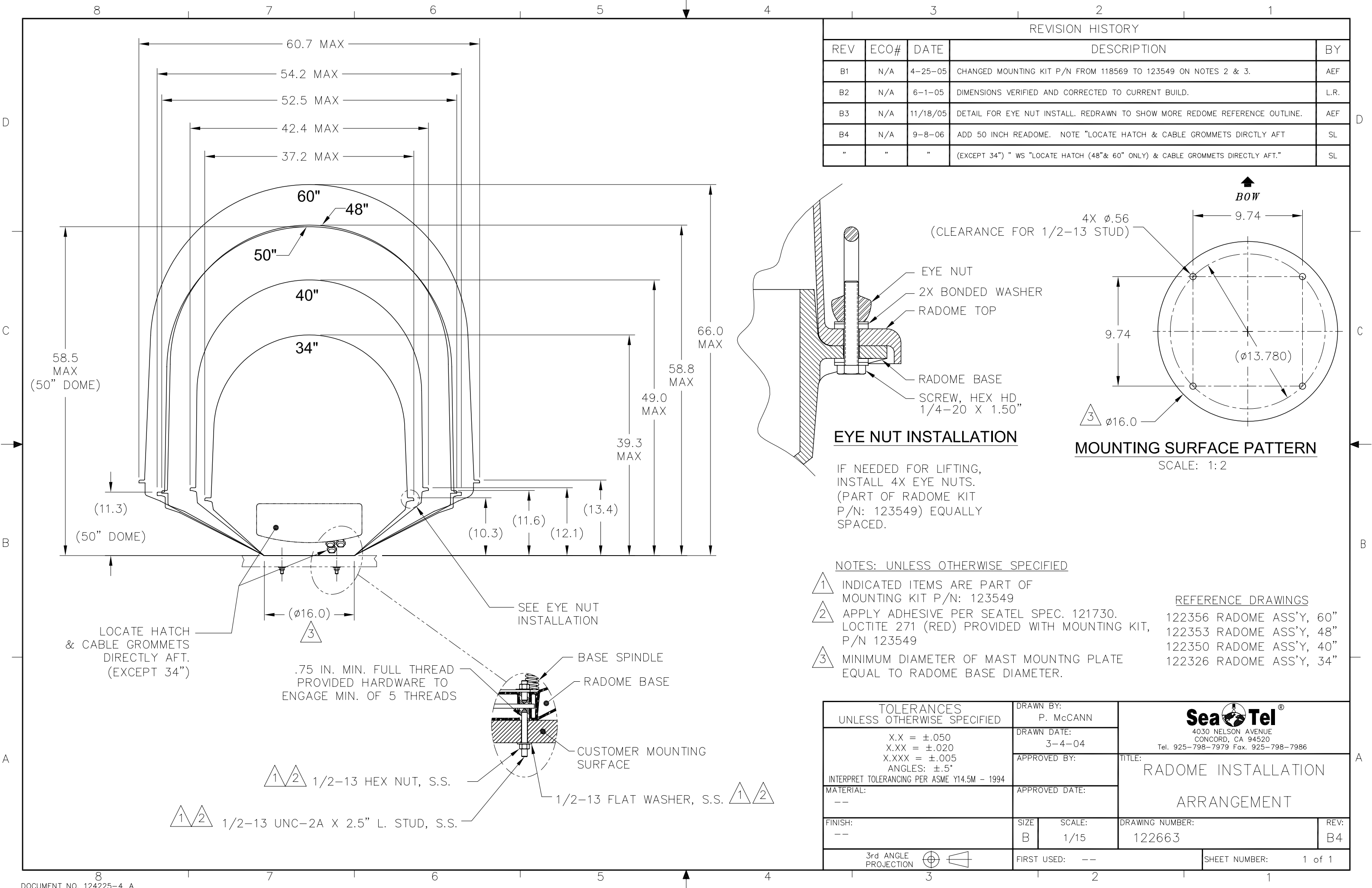
DASH	DESCRIPTION
-1	WHITE WITH FOAM
-2	FRENCH NAVY GREY WITH FOAM
-3	IRISH NAVY GREY WITH FOAM

- NOTES, UNLESS OTHERWISE SPECIFIED:
- 1 BOW MARKER LOCATION DIRECTLY OPPOSITE FROM ACCESS HATCH.
 - 2 POSITION DECALS AS SHOWN, CENTERED AT BOTH PORT AND STARBOARD. DECALS MUST BE PARALLEL TO RADOME FLANGE WITHIN .13 INCH AS MEASURED FROM THE BOTTOM OF THE 2 LETTER E's. DECALS MUST APPEAR CENTERED FROM 2 METERS AWAY.
 3. APPLY ADHESIVE PER SEA TEL SPEC. 121730.
 4. BAG AND ATTACH RADOME MOUNTING KIT, ITEM 14, TO INSIDE OF RADOME.

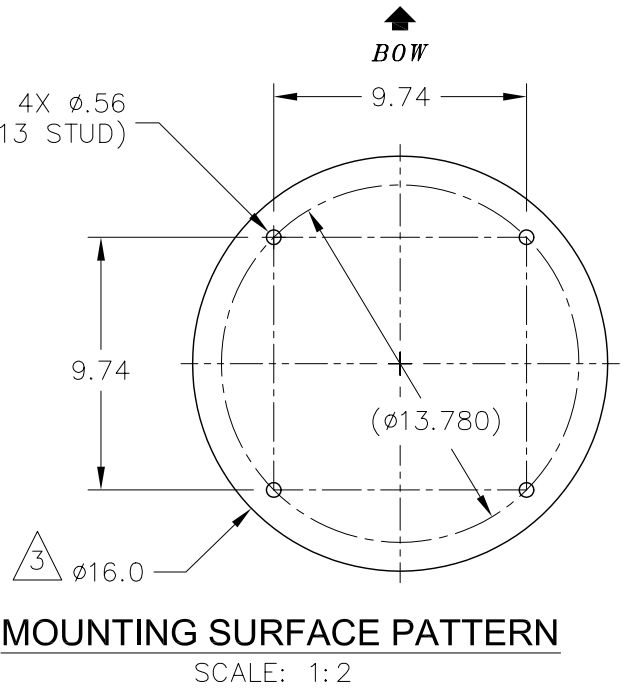
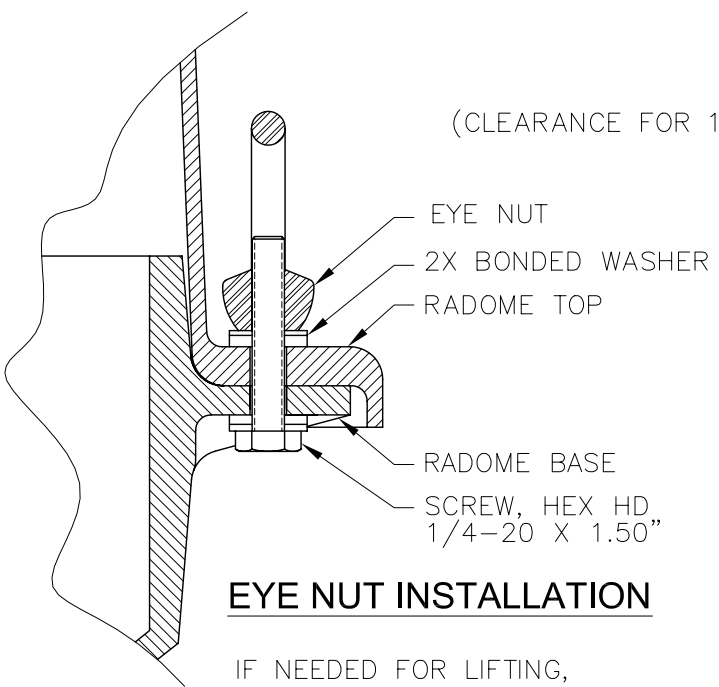
TOLERANCES		SeaTel			
UNLESS OTHERWISE SPECIFIED					
X.X	= ± .050"	SCALE: 1:10	APPROVED BY:		DRAWN BY: SCC
X.XX	= ± .020"	DATE: 5-3-04			DRAWING SIZE: B
X.XXX	= ± .005"	TITLE: RADOME ASSEMBLY, 48 INCH, GA INSTALL			
ANGLES	= ± 30'				
3rd ANGLE PROJECTION		MODEL: 4004	SHEET: 1 OF 2	DRAWING NUMBER: 122970	REVISION: F1



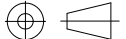
TOLERANCES		SeaTel	
UNLESS OTHERWISE SPECIFIED		SCALE: 1:3	APPROVED BY:
X.X	= ± .050"	DATE: 4/1/04	DRAWN BY: SCC
X.XX	= ± .020"		DRAWING SIZE: D
X.XXX	= ± .005"	TITLE: RADOME ASSEMBLY, 48 INCH, GA INSTALL	
ANGLES	= ± 30°		
3rd ANGLE PROJECTION		MODEL: 4004	SHEET: 2 OF 2
		DRAWING NUMBER: 122970	REVISION: F1

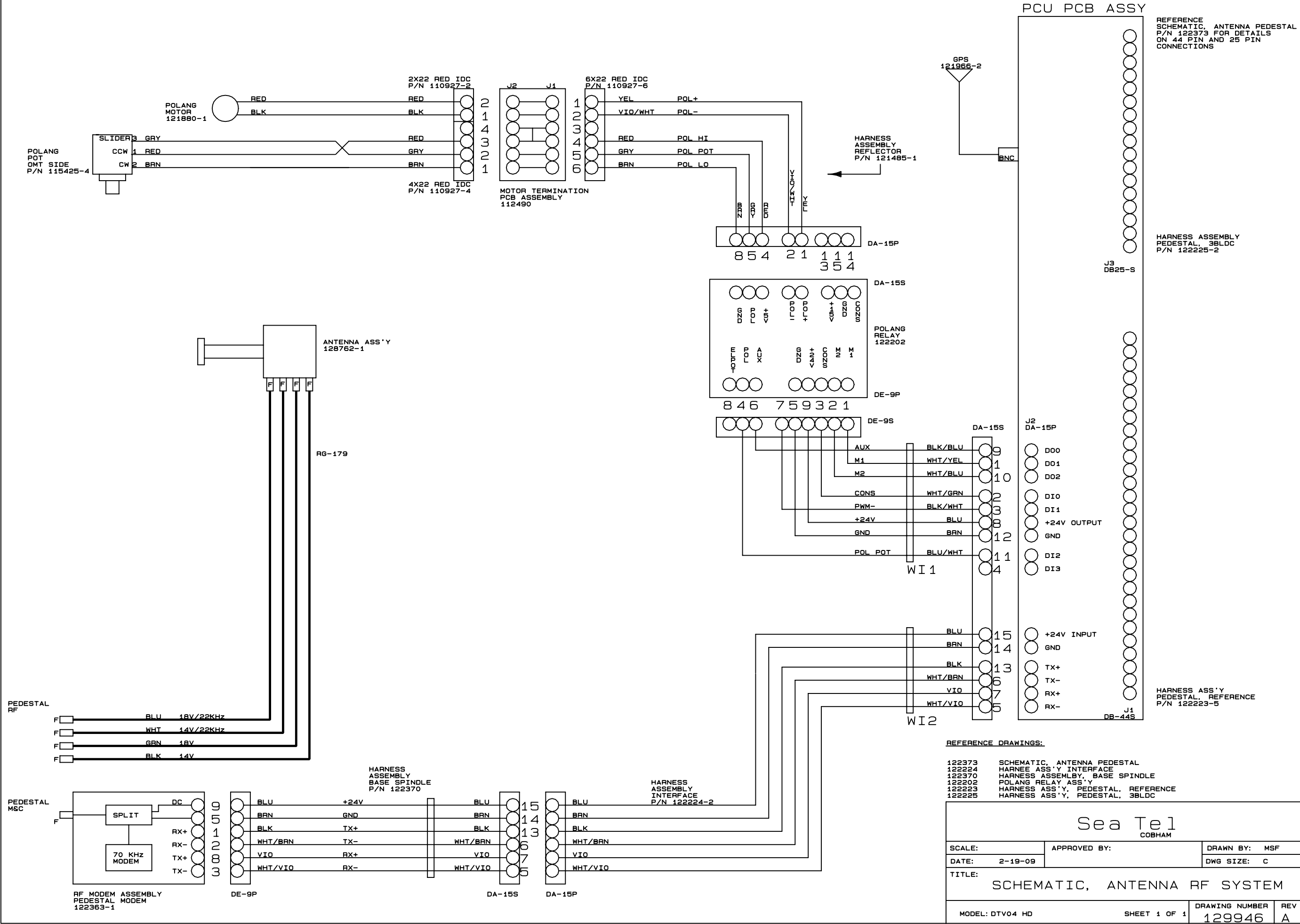


REVISION HISTORY				
REV	ECO#	DATE	DESCRIPTION	BY
B1	N/A	4-25-05	CHANGED MOUNTING KIT P/N FROM 118569 TO 123549 ON NOTES 2 & 3.	AEF
B2	N/A	6-1-05	DIMENSIONS VERIFIED AND CORRECTED TO CURRENT BUILD.	L.R.
B3	N/A	11/18/05	DETAIL FOR EYE NUT INSTALL. REDRAWN TO SHOW MORE REDOME REFERENCE OUTLINE.	AEF
B4	N/A	9-8-06	ADD 50 INCH READOME. NOTE "LOCATE HATCH & CABLE GROMMETS DIRCTLY AFT	SL
"	"	"	(EXCEPT 34") " WS "LOCATE HATCH (48"& 60" ONLY) & CABLE GROMMETS DIRECTLY AFT."	SL



- NOTES: UNLESS OTHERWISE SPECIFIED
- 1 INDICATED ITEMS ARE PART OF MOUNTING KIT P/N: 123549
 - 2 APPLY ADHESIVE PER SEATEL SPEC. 121730. LOCTITE 271 (RED) PROVIDED WITH MOUNTING KIT, P/N 123549
 - 3 MINIMUM DIAMETER OF MAST MOUNTNG PLATE EQUAL TO RADOME BASE DIAMETER.
- REFERENCE DRAWINGS
- 122356 RADOME ASS'Y, 60"
 - 122353 RADOME ASS'Y, 48"
 - 122350 RADOME ASS'Y, 40"
 - 122326 RADOME ASS'Y, 34"

TOLERANCES UNLESS OTHERWISE SPECIFIED		DRAWN BY: P. McCANN		SeaTel® 4030 NELSON AVENUE CONCORD, CA 94520 Tel. 925-798-7979 Fax. 925-798-7986	
X.X = ±.050 X.XX = ±.020 X.XXX = ±.005 ANGLES: ±.5° INTERPRET TOLERANCING PER ASME Y14.5M - 1994		DRAWN DATE: 3-4-04			
MATERIAL: --		APPROVED BY:		TITLE: RADOME INSTALLATION ARRANGEMENT	
FINISH: --		APPROVED DATE:			
		SIZE B	SCALE: 1/15	DRAWING NUMBER: 122663	
3rd ANGLE PROJECTION 		FIRST USED: --		REV: B4	
				SHEET NUMBER: 1 of 1	



REFERENCE DRAWINGS:

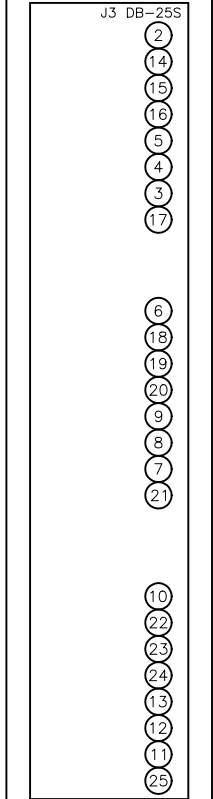
- 122373 SCHEMATIC, ANTENNA PEDESTAL
- 122224 HARNEE ASS'Y INTERFACE
- 122370 HARNESS ASSEMBLY, BASE SPINDLE
- 122202 POLANG RELAY ASS'Y
- 122223 HARNESS ASS'Y, PEDESTAL, REFERENCE
- 122225 HARNESS ASS'Y, PEDESTAL, 3BLDC

Sea Tel COBHAM			
SCALE:	APPROVED BY:	DRAWN BY: MSF	
DATE: 2-19-09			DWG SIZE: C
TITLE: SCHEMATIC, ANTENNA RF SYSTEM			
MODEL: DTV04 HD	SHEET 1 OF 1	DRAWING NUMBER 129946	REV A

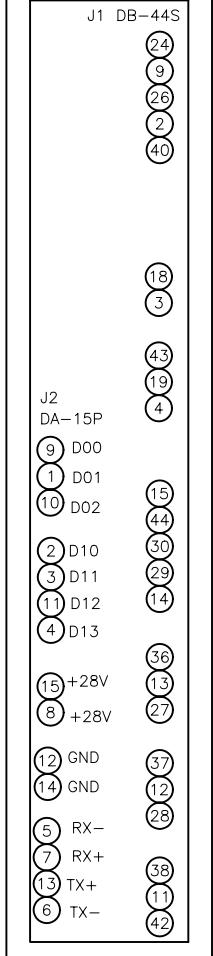
REV.	ECO#	DATE	DESCRIPTION	BY
A	4225	12-8-03	RELEASED TO PRODUCTION	P.M.
A1	N/A	12-29-03	UPDATED DWG REF. PEDESTAL HARNESSES (WS 120923-1 & 120924)	LK
B	4376	4-15-04	CHG WIRE COLOR ON BLDC MOTOR 121951	SCC
B1	N/A	1-28-05	J4 PIN 11 WS PIN 14. ENCODER P/N WS GIVEN (AS 116053). ENCODER IS PART OF MOTOR 121951.	AMN
B2	N/A	02-01-05	CORRECTED P/N ON LEVEL CAGE FROM 119528-1 TO 122937-1	AEF

PCU ENCLOSURE ASS'Y
P/N 121185

PCB ASSY, MOTOR DRIVE,
3BLDC P/N 120850

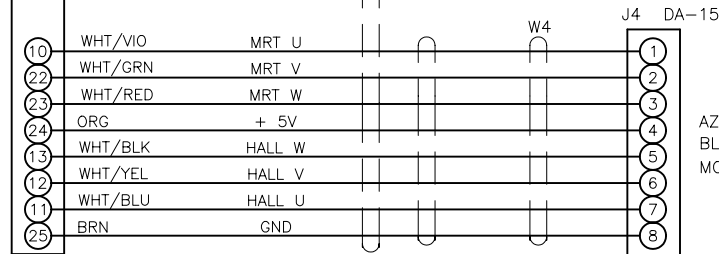
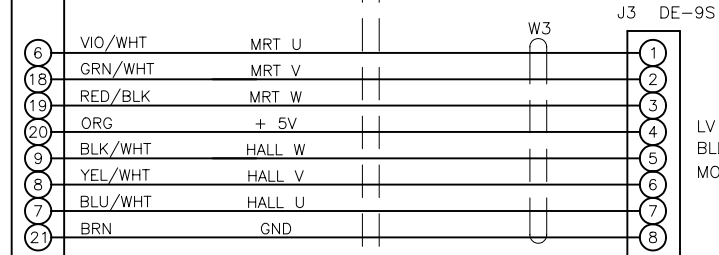
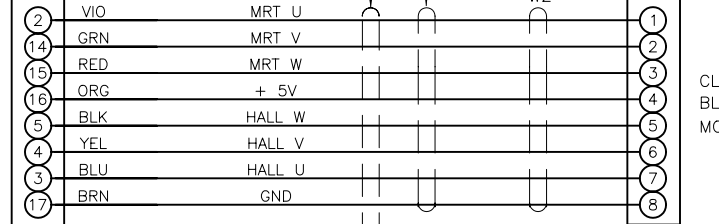


PCB PCU ASS'Y
P/N 121171



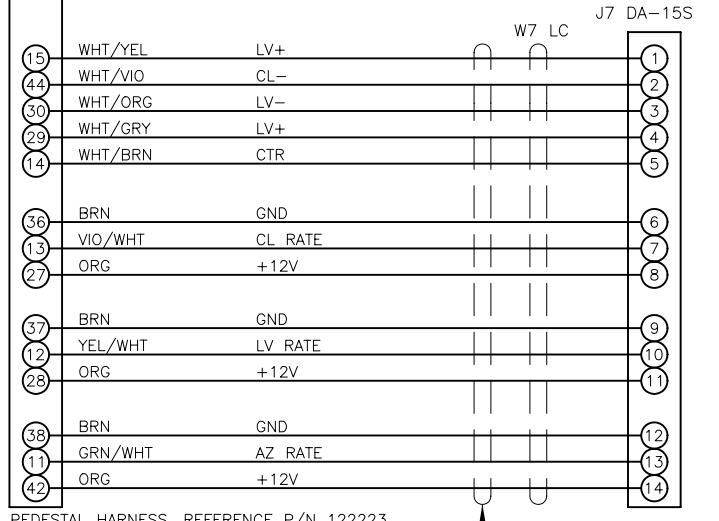
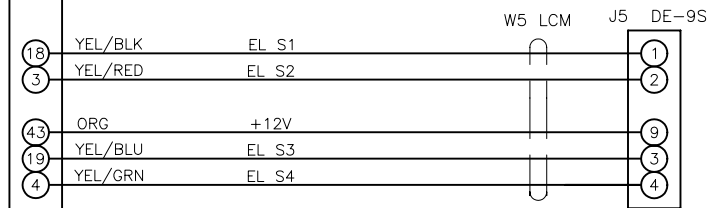
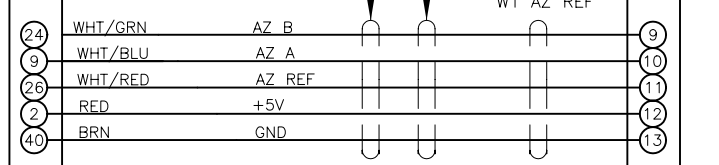
SEE ANTENNA RF SYSTEM SCHEMATIC
FOR FURTHER DETAILS ON THIS CONNECTION

DB-25P



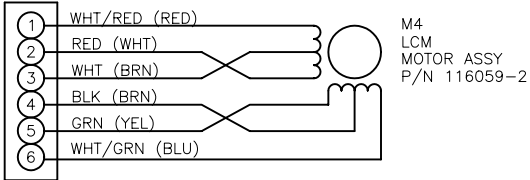
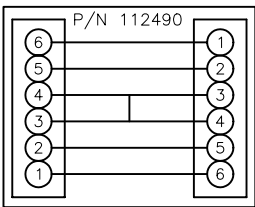
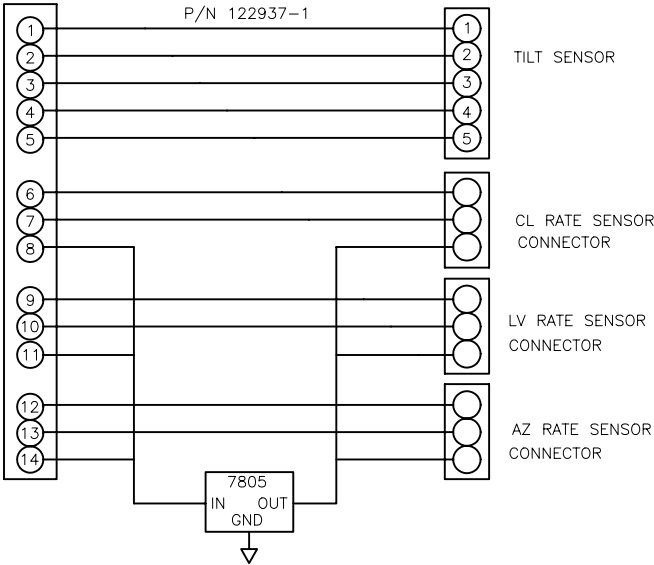
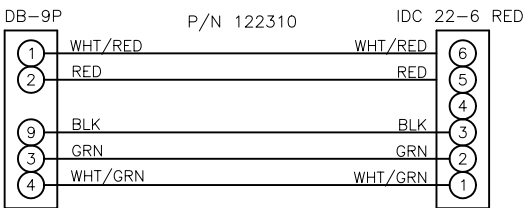
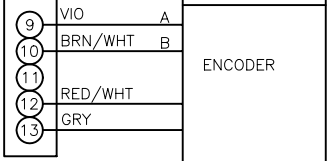
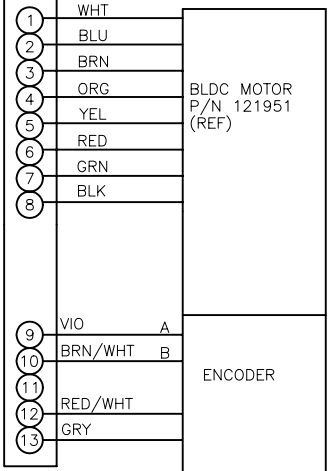
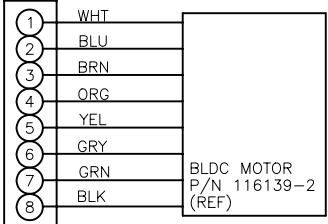
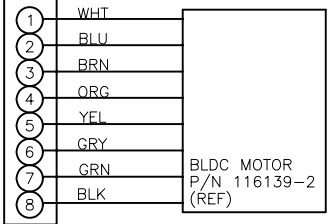
PEDESTAL HARNESS, 3 BLDC P/N 122225

DB-44P



PEDESTAL HARNESS, REFERENCE P/N 122223

LEVEL CAGE AXIS



NOTES: UNLESS OTHERWISE SPECIFIED

1. FOR WIRE LENGTHS AND ASSEMBLY DETAILS. SEE
PEDESTAL HARNESS ASSEMBLY.

REFERENCE DRAWINGS:

121172 PCU PCB SCHEMATIC
121986 ANTENNA SYSTEM SCHEMATIC

TOLERANCES		Sea Tel		
UNLESS OTHERWISE SPECIFIED		APPROVED BY: P. McCANN		
X.X	= ± .050"	SCALE: NONE	DATE: 9-18-03	DRAWN BY: P. McCANN
X.XX	= ± .020"	DRAWING SIZE: C		
X.XXX	= ± .005"	TITLE: SCHEMATIC, ANTENNA PEDESTAL		
ANGLES = ± 30°		MODEL: XX04		
3rd ANGLE PROJECTION		SHEET: 1 OF 1	DRAWING NUMBER: 122373	REVISION: B2